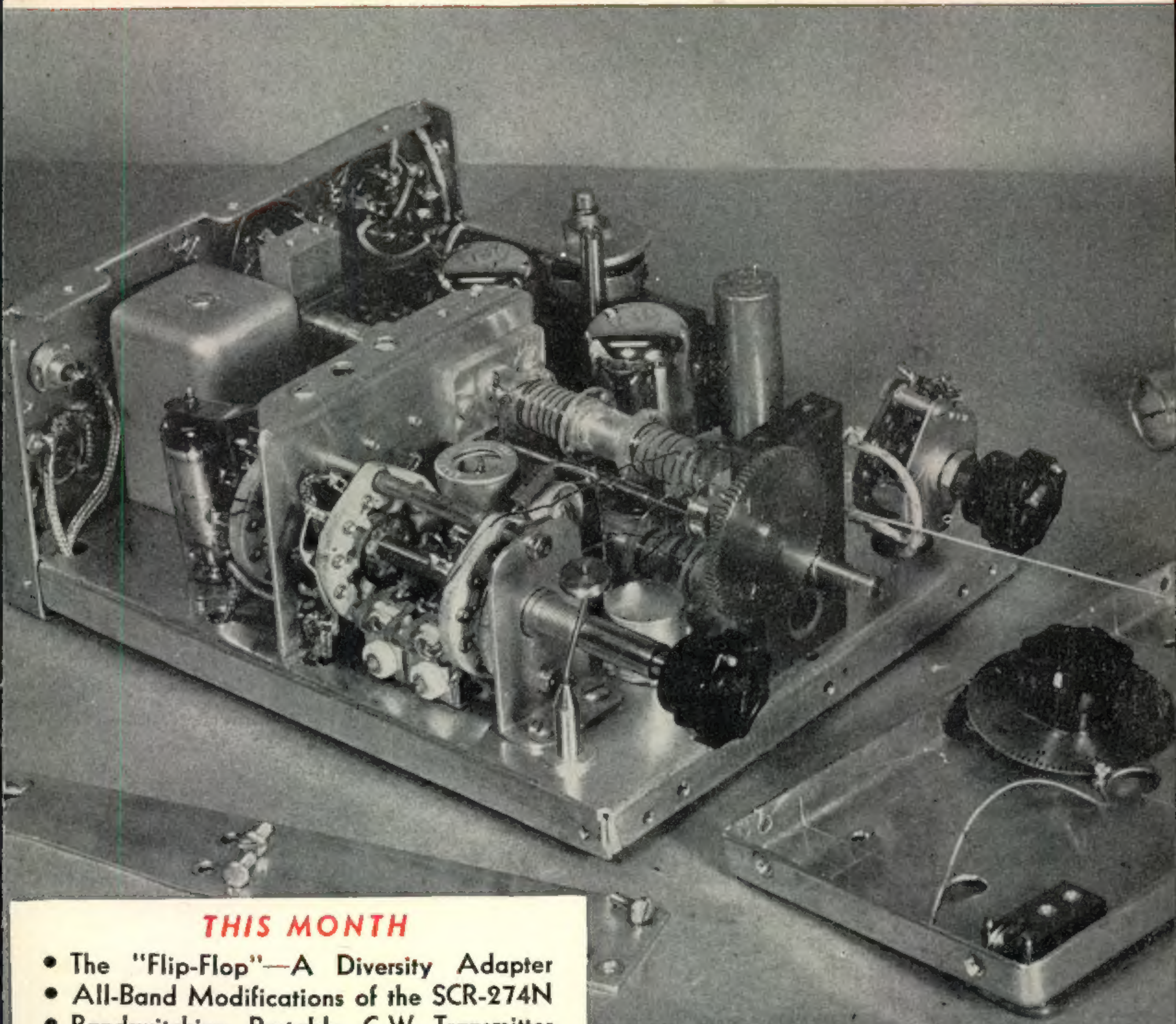
CQ

JULY, 1948

The Radio Amateurs' Journal

35¢



THIS MONTH

- The "Flip-Flop"—A Diversity Adapter
- All-Band Modifications of the SCR-274N
- Bandswitching Portable C-W Transmitter
- A New Theory of V-H-F Ground Wave DX

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CQ

The Radio Amateurs' Journal

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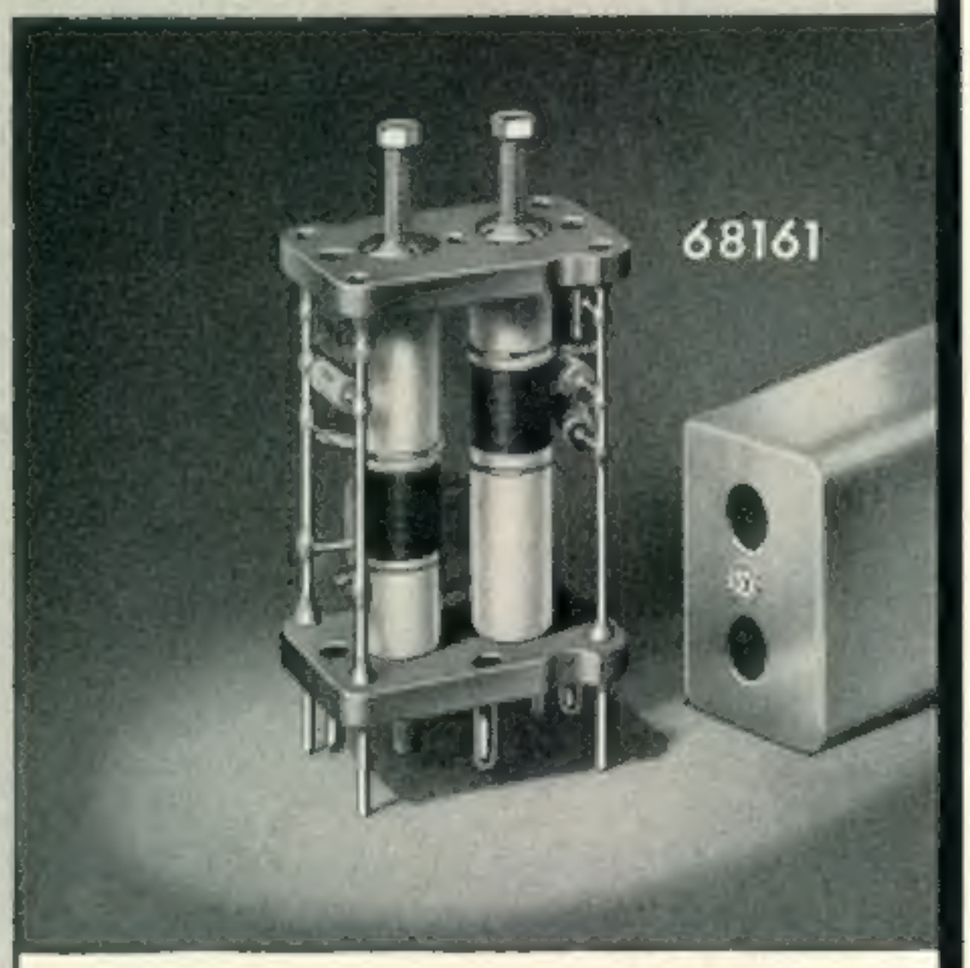
Vol. 4 **JULY, 1948** No. 7

In This Issue

COVER—With the likelihood that mobile operation on all amateur bands is just around the corner, mobile converters will have to be expanded in coverage. In August *CQ*, George Brown, W2CVV, will describe the beautifully engineered converter for 10 and 75 pictured on the cover this month. Built to give service equal to the nearly indestructible automobile receivers, its performance matches the home station super. Some of its features are direct calibration with high reset accuracy, inductive tuning, and miniature tubes throughout.

Letters....4
Scratchi....8
Zero Bias (*Editorial*)....11
The "Flip-Flop"—An Effective Diversity Adaptor
W. Roderic Bliss, WØSNH....13
Bandswitching Portable C-W Transmitter
Harry R. Hyder, W3NVL....16
Commentaries:
Permeability-Tuned V.F.O.—*Owen J. McCabe, W1COJ*....20
Simple Plug-in V.F.O.—*Moe Joffe, W2BNY*....21
"Oscar"—A Milliammeter for the Sightless Amateur
H. S. Brier, W9EGQ, and V. O. Christman, W9WEU..22
Parasitic Beam Patterns
David C. Cleckner, W8YBF....25
Shack and Workshop....30
The TV Receiver: Its Operation and Common Forms of Interference
William Brown, W2IBK....31
You *Can* Live with TV! Part II
H. M. Bach, Jr., W2GWE....36
Grounded-Grid V.F.O. Coupling Amplifier
Eugene Black, W2ESO....39
V-H-F Ground Wave DX
Oliver Perry Ferrell....40
Looking Over the SCR-274N
Modifications for 80 and 40 Meters—*E. B. McIntyre, W3KHJ*....42
Modifications for 11 and 10 Meters—*G. V. Dawson, WØZJB*....43
The YL's Frequency....45
Monthly DX Predictions—July....46
V.H.F.-U.H.F....48
50-mc Honor Roll....49
DX and Overseas News....50
W.A.Z. Honor Roll....52
Parts and Products....54
From the Private Lives of CQ....56
Hamfests....82
Advertising Index....96

Designed for Application



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★ ★ ★ Letters ★ ★ ★

The Case for the VE

Box 148, Flin Flon, Manitoba

Editor *CQ:*

With reference to your editorial in the April issue of *CQ*, I am one of five of those Canadians you mention, whose affections have been alienated by the risk you took, not in stating it was unfair for 50 kc on 75 and 20 to be considered inviolable by VEs nor that Canadian amateurs were a minute percentage, but by your statement that VEs were running power equivalent to the U.S. legal limit. This is quite untrue. All VE licenses state: "the input power to the antenna shall not exceed 500 watts." I might add that since receiving my license in 1936 I have met only one amateur who was running the full legal limit, but no doubt there are more.

This is due to two very obvious reasons: First, radio equipment in Canada is considerably more expensive, approximately one dollar per watt, and there was not the great supply of war surplus equipment in Canada as in the United States. Second, a very large percentage of VEs are in the rural districts or scattered over the north in trading posts, etc., where there are no a-c mains, so they must generate their own power.

Possibly the minute percentage of VEs you refer to as compared to Ws is due to the fact that the VEs you hear are the only ones running over 50 watts. We would gladly welcome with open arms all Ws to our extra 50 kc per band, if they will just as gladly bury that other 500 watts we don't have!

Now that we have that off our chests we still think *CQ* is an "A1" publication, we are all for it.

R. S. Pollock, VE4EO (150 watts input)
W. Kirkwood, VE4EQ (50 watts input)
John Kuhny, VE4OB (50 watts input)
John Ash, VE4FG (12 watts input)
G. Woodward, VE4YM (400 watts input)

Sackville, N. B.

Editor, *CQ:*

. . . If anyone were to keep an accurate log of the power used by VE and W contacts over a given period of time, VE for W, you would find that the average power of the W would be in the neighborhood of 300 watts while that of the VE would run about 75 to 100. I am speaking in particular of the 75 and 20-meter phone bands where power used is more of a governing factor for QRM free (if there is such a thing) contacts than anything else.

A person might well ask if such is the case why don't the VEs add a few more watts to their output. The answer is that dollar for dollar the average VE can't afford to. As you are probably aware, most of all our equipment comes across the border from your country and before we can walk it home we must pay in duty to our Custom and Excise Department approximately 30% on the purchase price. Until recently it used to be considerably more. To illustrate this point, the writer purchased a year ago a new HQ-129X receiver from one of the Canadian radio houses (the price being the same right across the country) and this receiver cost me exactly $267.50, when the identical receiver in the States was priced at $173.00. Of course the same example holds true for transmitters and other equipment.

You mention in your editorial that some effort should be made to convince the Canadians that they should give up either in part or full their extra

PR's pay off!

Whether you're stalking an Asian or probing for a W6 . . . you'll find that PRs pay big dividends. Today's crowded bands emphasize more than ever that it PAYS TO STAY PUT. It's no fun to drift on the sea of QRM . . . unknown, unloved, un-QSOed. It's a lonely life at best. More and more, smart operators are sticking to crystal control for all but special occasions. Pick your favorite frequencies . . . buy inexpensive PR Precision CRYSTALS to cover them. You'll find that life on the bands isn't so bad after all. USE PR and KNOW WHERE YOU ARE! Get the exact frequency (integral kilocycle) at your jobber's. PRs are unconditionally guaranteed.—Petersen Radio Company, Inc., 2800 W. Broadway, Council Bluffs, Iowa. (Telephone: 2760)

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10 METERS PR Type Z-5.	Harmonic oscillator. Ideal for "straight through" mobile operation. High activity. Heavy drive without damage in our special circuit $5.00
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40 & 80 METERS PR Type Z-2.	Rugged, low drift fundamental oscillators. High activity and power output with maximum crystal currents. Accurate calibration..$2.75

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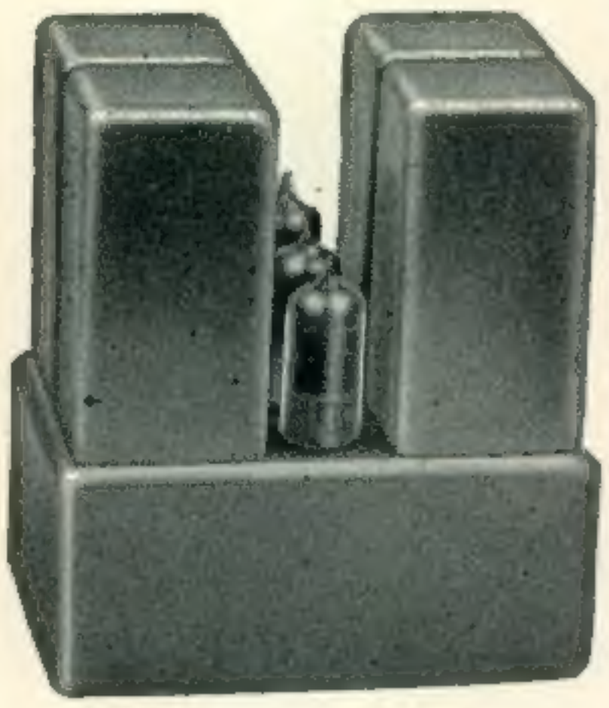
We use "revolutionary" advisedly. You'll agree when you add new "805" 100 kc. I.F. Amplifier to your present receiver that the phone/broadcast selectivity and noise reduction it gives are revolutionary. *Less* than this improvement has been described as "like nothing you've ever seen or heard before". Added to any superhet having i.f. lying between 450 and 500 kc., Model 805 will cut dial-spread on even the strongest local station down by 75% . . . will reduce noise unbelievably. It gives your present set a selectivity curve of 2.4 kc. wide 2X down, falling almost vertically to only 7.2 kc. wide at 10,000X down—an engineering dream come true. 805 gives single-side-band selectivity, the ability to reject noise, heterodyne squeals and all QRM on one side of the signal or the other—yet get clear, crisp speech and music without deleterious side-band cutting.



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phone frequencies. Might I suggest for your consideration that in view of the foregoing you try and convince our Custom lads to do away with the custom, excise and sales tax (an extra 8%, by the way) in order that we may then be placed on an *equal* basis.

I claim, in common with the other VEs, that there is no great inequality now. If, however, your suggestion were followed and the cost of our equipment remained the same, I think that *we* then could honestly claim inequality, the result of which would be that the average VE phone lad might as well utilize your Classified Advt. section.

Ronald J. Hesler, VE1KS

Frequency Allocations and Usage

P. O. Box 242, Dryden, N. Y.

Editor, *CQ:*

In your April, 1948, *CQ* editorial you presented some thoughts on phone-c.w. band division which I found very interesting, and I might add, well thought out. However, like most individuals, I have some further ideas on this subject that I would like to bring to your attention.

First I would like to say that I think your comments about the present extra 50-kc phone assignments for the Canadians is very pertinent. As you point out, this results in a comparatively few having a phone band 50 kc greater than the Americans. Shouldn't this be just the other way around? This extra 50-kc business seems to me to be a "viscious circle" affair.

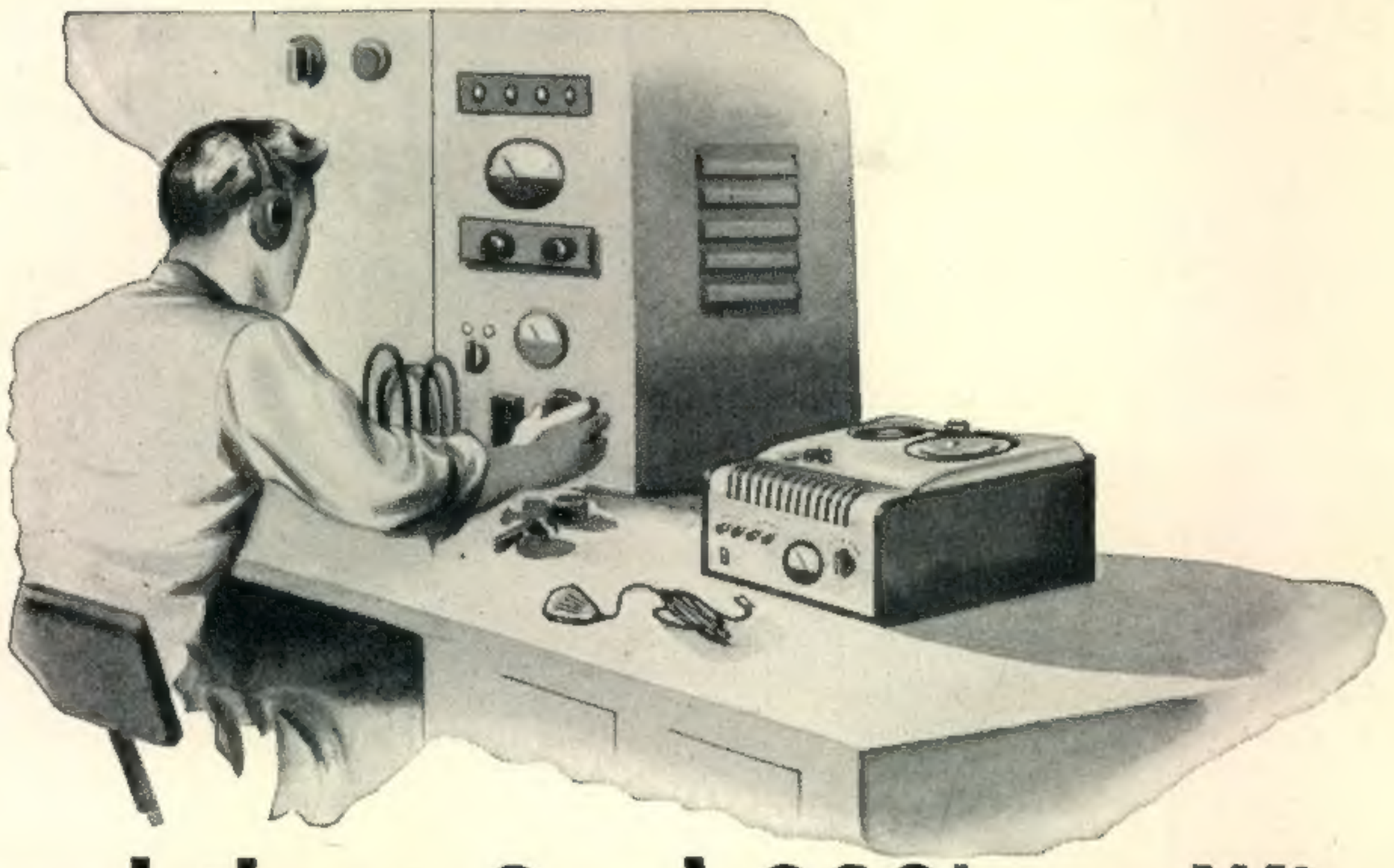
I have held the opinion for some time that the amateur frequency bands extending from 3.5 mc to 29.7 mc should be classified into three groups representing three basically different operating conditions, and that each group type should be fairly divided for code and phone operation. One thing I object to is having the bulk of the phone frequencies on the 28.0–29.7 mc band and the bulk of the code frequencies on the lower frequency bands. The grouping I have in mind is as follows:

1) Short and medium distance communication frequencies: 3.5–4.0 mc and 7.0–7.3 mc.
2) Long distance communication: 14.0–14.4 mc.
3) Irregular long distance and local communication: 28.0–29.7 mc.

Since each amateur band actually represents a different "optimum distance" communication range, I feel that basically both phone and code operation should be allowed on *each* band. However, as you have said in the editorial, the division of each band is not quite this simple since we have to consider such things as the extra 50 kc taken by the Canadians, foreign amateur stations with non-coincidental assignments, foreign broadcast stations, etc. I do believe though, that we should try, if possible, to divide each band equitably.

This equitable division statement brings up another interesting point not touched upon in your editorial which I feel needs a lot of thought. My approach to it results in the following reasoning: It is an established fact that code-phone operation is divided about 50–50. (A.R.R.L. survey report—June, 1947, *QST*, page 71.) Under present methods of communication we need for a phone station at least 3 kc of bandwidth and 1 kc for a code station, or three times as many phone frequencies as code frequencies, assuming the 50–50 operating time division mentioned above, for the same relative amount of interference within each service. Some

(*Continued on page 93*)



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Model 78 Wire Recorder is ideal for handling traffic—no chance of error in relaying important messages.

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(Secret Hush Hush Male)

Deer Hon. Ed:

You are to please be treating this letter most confidentially as it are containing most sensayshunal amateur radio discovery since invention of radio. As you are no doubtless knowing, Hon. Ed., Scratchi are reely 1/c scientist. While I are in U. S. Armies in last war I are practikally inventing radar singlehanded. Recently I are figuring on things and are getting brilliants idea. Brother Itchi are thinking idea are hots-stuff too and he are letting me have a little shack in far corner of his ranch. Here Scratchi are experimenting for weaks on end and he are finally coming ups with a device which are going to be a boons to all hams.

I are calling this (Hon. Ed., making sure that knowbuddys are peeking over Hon. Shoulder) by the initials S.S.S.C. Without a doubtless this are going to be biggest thing ham radio are ever having. It are so new and different that I are even amazed at myself. Wate till you are heering about it. The initials S.S.S.C. are standing for Scratchi's Sooper Secret Cadoodaler. Knowing you are eminent authority on radio I are making post haste to giving you the full details.

My invention are a black box with many connections on it. I are going to fix it so that it can't be taken apart, so that no one else can getting Scratchi's secret. And, even if someone are able to open up box, they will be finding that parts are not the same, dueing to exposure to air. This magic black box are doing all things that are normally giving hams trubble.

For examples, taking all those things where the ham are faced with the problem of which wire goes where. When he are connecting up meter to reeding grid current, meter are always going off scale backwards, so it are necessary to reversing wires. Or taking case of geranium crystals. When it are first being put in it are never rectifying till it being turned around. Same are being true of millenium rectifiers. And if ham are having a.c.-d.c. power supply he are always plugging it in a-c line backwards. All of these trubbles are automatically eliminated by S.S.S.C. By connecting to rite wires connections are always being made rite first time out of the box. And, when connections are made, it are simple to taking out black box and using it on next connections.

Of course it are also doing many other things. When S.S.S.C. are connected between two stages second stage are always getting rite amount of drive. When screen-grid toobs are used, black box can be connected in screen lead so that screen voltage and current are always rite. I are even arranging black box so that it are acting as adapter. That is, I are plugging black box into toob socket and plugging beam-power toob into black box. When

(*Continued on page 85*)

NEW!

STANCOR'S ST-203-A Mobile Transmitter Kit

THE STANCOR'S ST-203-A is a compact, versatile transmitter designed primarily for mobile operation, but also useful for fixed station service. You can operate the ST-203-A in your car, then quickly transfer it for use in your shack, summer home or other fixed location. Special mounting fasteners make the ST-203-A quickly transferable from car to fixed station.

Power is obtained from a dynamotor or vibrator supply for mobile work or from an AC supply at a fixed location. Performs efficiently with the surplus PE-103-A dynamotor and a T-17B carbon microphone.

Briefly, the circuit lineup consists of a 6V6 harmonic oscillator working from 7 mc. crystals, a 2E26 Class C amplifier, a 6J5 grounded-grid speech amplifier, and a push-pull 6V6 Class A-1 modulator.

Attractively styled in silver-gray hammertone finish with gray plastic control knobs and brushed metal carrying handle. Size only 8 5/8" x 7 3/8" x 6 3/4". Weight with tubes and crystals, 9 1/4 pounds.

Kit includes prefabricated chassis, mounting plate, dust cover, prepared lead wires, all constructional components, and detailed, illustrated instruction manual. **AMATEUR NET PRICE,** less accessories . . . **$44.70**

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IN YOUR SHACK

AT YOUR SUMMER HOME

NOTE THESE FEATURES:

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- Series noise limiter
- Universal antenna input
- Built-in PM speaker
- Beat oscillator
- 2.5 watt audio output

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Overall tuning range: 540 kc to 54.5 Mc. Band 1: 540-1630 Kc; Band 2: 2.5-6.3 Mc; Band 3: 6.3-1.6 Mc; Band 4: 14-31 Mc; Band 5: 48-54.5 Mc.

Controls: main tuning, bandspread, bandswitch, RF gain, audio volume, tone control, noise limiter, standby-receive, phone-code switch, speaker-headphone switch and phone jack on rear panel. Input jack for record player pickup connection.

New superhet circuit uses: 1—6C4 oscillator; 1—6BA6 mixer; 2—6BA6 IF's; 6H6 detector-AVC-noise limiter; 6SC7 BFO-1st audio; 6K6GT audio output and SY3 rectifier.

Size: 12⅞" x 6⅞" x 7⅞".

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EDITORIAL

WE HAVE COME to learn that 6-meter men are a strange segment of the amateur fraternity. On a per capita basis their general technical know-how is somewhat above the average of the occupants of the other bands. Oft-times they speak glibly, but knowingly, of such items as threshold sensitivity, tropospheric refraction, rebound F2-scatter, auroral distortion and high density sporadic-E clouds. To be sure, they too concern themselves with how to get out and how to work DX, even when situated on this borderline (for DX) amateur band. To their brethren on the lower frequencies it just does not seem worth while. But at writing it appears that the ardent followers of 6 meters are coming into a world of their own. For 6 meters is to be the scene of a Government-sponsored research project based entirely upon radio amateur data.

The research project is a cooperative effort between the Geophysical Research Division of the Watson Laboratories (Air Materiel Command, USAF) and *CQ*, acting on behalf of the radio amateurs. A work group of approximately 200 amateurs is being formed to report on the occurrences of sporadic-E short skip. Co-directors of this special group are V.H.F. Editor Dawson and Assistant Editor Ferrell whose field of specialization is propagation. The objectives of the work group will be to obtain sufficient data to definitely establish the frequency of occurrence of sporadic-E, possible correlations with other phenomena to determine the cause, and particularly to study the shifting of the skip zones which is assumed to be indicative of air circulation at the height of the E-region (65 miles).

We of *CQ* have unhesitatingly thrown our full efforts into getting the project started. Reporting forms have been distributed and the data thus obtained will be carefully analyzed by a special staff at the Watson Laboratories. The inception of the project was a study made by Ferrell into the question of skip zone drifting. It was found that the drift could be resolved into terms of air circulation at this great height. Only by using 6-meter amateur data has it been, or probably would it ever be, possible to ascertain the direction and velocity of this drift. A short note announcing this discovery is currently appearing in the *Proceedings of the I.R.E.*

The importance of this project both from the viewpoint of amateur interests and in furthering our knowledge of the ionosphere should not be underestimated. Considering the latter point first, it might be well to quote directly from a recent survey of ionospheric literature made by Larry Manning, W6QHJ, of the Department of Electrical Engineering, Stanford University (Final Engineering Report No. 1-F1, Air Materiel Command, USAF). Under the subject of recommendations (for further research) we find: " . . . after having made an extensive survey of existing knowledge of high altitude radio propagation . . . one is struck by the fact that in almost all branches of investigation a tremendous lack of knowledge exists. A very great deal would be explained concerning irregularities in the ionosphere if we could draw maps of ionospheric winds to compare with tropospheric weather. Very likely once this had been done for an appreciable region, it would be found that top-side weather could be predicted from bottom-side observations." In addition: " . . . by noting the regions of sporadic-E origin and occurrence, the origin of this mysterious ionization may itself be explained." Naturally, the problem is much more extensive. The direction of high velocity winds in the E-region must be determined if the accuracy of rocket fired missiles is to be increased. Also, the spatial distribution of sporadic-E must be found and the possible effect upon radio frequencies above and below the 50-mc band estimated.

The opportunity for radio amateurs to partake in a research project which is extremely important and promises to show finite results in a short time is especially gratifying. To a great extent amateur observations have in the past been largely dismissed, due primarily to the lack of organization in forming competent work groups. This resulted in haphazard reporting which could not be accepted for scientific study. Under such circumstances it is practically impossible to claim prior knowledge, e.g., of auroral scattering which was suddenly "discovered" last fall by British observers. Rather than offer the opportunity to create similar situations, *CQ* has made it a point to assemble, tabulate, and whenever possible analyze irregularities in radio transmission. The formation of this one project is evidence that radio amateur data and observations—once properly assembled—is felt to be of sufficient value to warrant extended study.

Numerous other avenues of investigation in which the radio amateur could supply vital data are still open. Undoubtedly, as the sporadic-E project progresses it will attract considerable attention. Whether or not this project will be successful depends on a small group—of proven ability—but we feel certain that the spirit of the whole fraternity is behind them to a man.

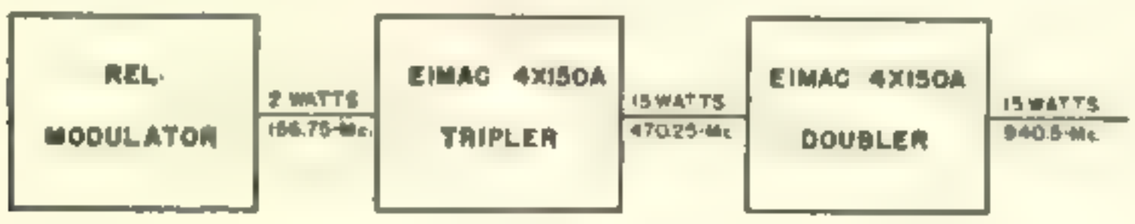
—*W2IOP*

15 WATTS AT 940.5-Mc. with the EIMAC 4X150A TETRODES

FREQUENCY UP 6X, (156.75-Mc. to 940.5-Mc.)
POWER UP 7X (2 watts to 15 watts)

Eimac 4X150A

Here's a STL transmitter that's in operation on the new 950-Mc. band, fulfilling all the FCC requirements and powered by Eimac 4X150A tetrodes. It's a part of the studio-transmitter-link between the San Bruno studios and the 250 Kw FM transmitter of station KSBR high atop 3849-foot Mt. Diablo some 33 miles away.



The R-F amplifier was specifically designed for the KSBR application by Eimac engineers. It is driven by an REL modulator delivering 2 watts output at 156.7-Mc. to one Eimac 4X150A in a tripler stage, which in turn drives a single 4X150A in a doubler stage, providing 15 watts useful output at 940.5-Mc.

The Eimac 4X150A is ideally suited for this application because of its high power gain at relatively low plate voltages, ability as a frequency multiplier without loss of amplification, low grid drive requirements, and a high ratio of transconductance to capacitance. It also has the advantage of being physically small and functionally designed for simple installation.

Complete data on the Eimac 4X150A for STL and other UHF applications is available by writing direct.

EITEL-McCULLOUGH, INC.
197 San Mateo Avenue, San Bruno, California

EXPORT AGENTS: Frazar & Hansen—301 Clay St.—San Francisco, Calif.

ESSENTIAL DATA
KSBR STL TRANSMITTER

REL MODULATOR, MODEL 694
EIMAC 4X150A, R-F AMPLIFIER

Useful Output Power	15 watts
Frequency	940.5 Mc.
Frequency Stability	.002%
Audio Frequency Response.	
Substantially flat	50 to 15,000 cycles
Distortion	.5% Max.
Noise Level	70 db below 100% modulation
	± 100 Kc. deviation

Eimac 4X150A

General Characteristics

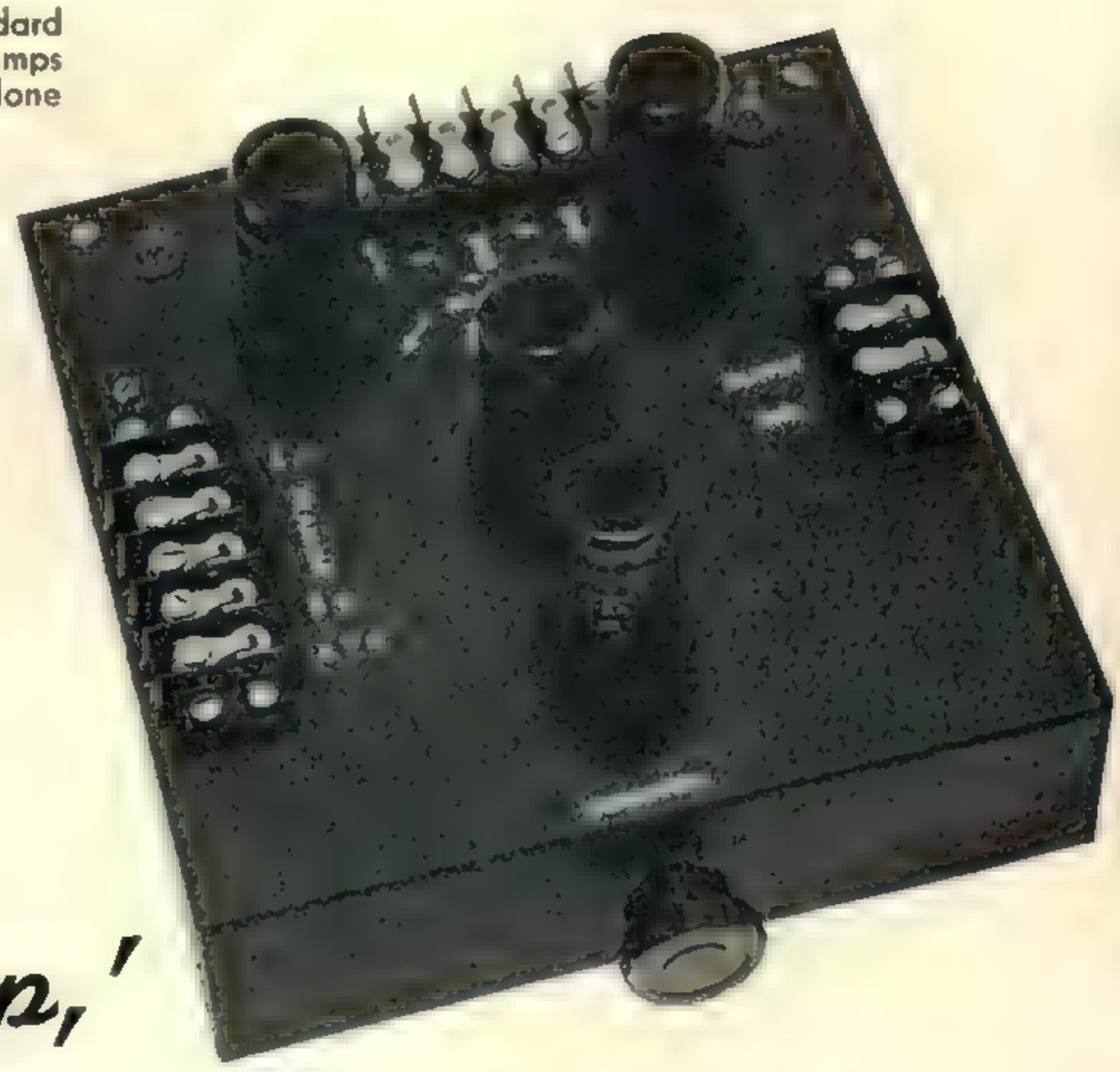
Heater voltage	6.0 volts
Heater current	2.8 amps.
Minimum heating time	30 secs.
Grid Screen amplification factor	4.5
Direct interelectrode capacitance (Average)	
Grid-Plate	0.02 μμf
Input	14.1 μμf
Output	4.7 μμf

Maximum Ratings

D-C Plate voltage	1000 volts
D-C Plate current	250 ma.
Plate dissipation	150 watts
D-C Screen voltage	300 volts

Follow the Leaders to
Eimac TUBES
The Power for R-F

The complete adaptor occupies comfortably a standard 7" x 7" chassis. Two neon antenna indicator lamps are visible in the two upper corners. Labeling is done with readily available decals.



W. RODERIC BLISS, WØSNH*

The "Flip-Flop," An Effective Diversity Adaptor

ONE OF THE most annoying characteristics of short-wave reception is the fading encountered on weak and distant signals. By some diabolical design the signal always fades out at the moment the choice bit of DX is giving such important information as his call, his QTH, or your report. This fading is caused not only by fluctuation of signal amplitude at the receiving antenna, but also by change of polarization of the radio wave. An effective way to minimize the fading encountered on any one antenna is to use two or more antennas located a few wavelengths (or more) apart or of different characteristics. Sufficiently different characteristics may be obtained by using one vertical and one horizontal antenna, two horizontals at right angles to each other, or a beam and a long wire antenna. The two antennas cannot be simply connected in parallel and attached to the receiver, as under some conditions the two signals might be actually of good strength but out of phase, causing cancellation of the signal and apparent fade-out. In commercial receiving centers, several receivers are used, each connected to its own antenna, with a common audio output system and often a common a-v-c system. The receiver with the strongest signal always supplies most of the output, and fading is thereby held to a minimum. Receivers with dual r-f and i-f channels have been made for diversity reception. Although their performance is undoubtedly good, the cost of such an arrangement is out of reach of most amateurs.

The alternative to using duplicate receivers is to switch the receiver from one antenna to the other as the signal fades. This cannot be done manually with any satisfaction because of the delay in the human nervous system and the requirement of a third hand to operate it. An automatic electronic switch, the "Filp-Flop," may be constructed and put to work by wiring up the simple circuit to be described. This circuit automatically switches the two antennas back and forth, searching intently for a signal. As soon as the receiver finds one on either antenna, it keeps the switch thrown to that antenna as long as the signal is of satisfactory strength. If the signal fades, it switches instantaneously to the other antenna, which in most cases will restore the signal to normal strength again. As the receiver tunes in various signals in the band, the Flip-Flop always chooses the antenna with the greatest signal strength.

Eccles Jordan Scale-of-Two Counter

The nearly human action of the unit is achieved by using a 6AC7 amplifier tube connected to each antenna, with the d-c tube circuit arranged as a modified Eccles-Jordon scale-of-two counter. This counter is a circuit similar to a multivibrator, except that it responds to low frequencies, including d.c. Since the time constant of the feedback network is infinity, when one tube is conducting the other is cut off, and will remain so indefinitely. A pulse from another source introduced into the circuit will cause the counter circuit to reverse. This circuit is generally called a "flip-flop." The 6AC7 which was conducting will be cut off and the 6AC7 formerly cut off will conduct. Since only the conducting 6AC7 will allow antenna signals to pass, an instantaneous switch of antennas is accomplished in the common r-f output circuit of the two 6AC7s.

*c/o Decimeter, Inc., 1430 Market St., Denver 2, Colo.

The tube used to generate pulses is a 6SC7 double triode. The two triodes obtain positive feedback through the common cathode resistors and the coupling condenser *C8*. The over-all configuration is that of a cathode-coupled multivibrator with one short time constant (*R18* and *C7*) and one long time constant (*C8* and *R17*). This results in the generation of short duration pulses repeated several times a second. The pulse output is differentiated by *C3* and the grid-to-ground resistors in the 6AC7, the flip-flop of the 6AC7s being actuated by the leading edge of the *T3* pulse.

In order to stop the switch when a signal appears, a lead is brought out from the a-v-c bus in the receiver. This goes to the 6SC7 double triode d-c amplifier through a voltage adjusting circuit. The output of the 6SC7 is connected to the grid return of one triode of the 6SC7 pulser tube. When as little as .05 volts of a.v.c. is developed in the a-v-c system, the pulser tube stops, and allows the 6AC7 amplifier tube which caused the a.v.c. to remain conducting.

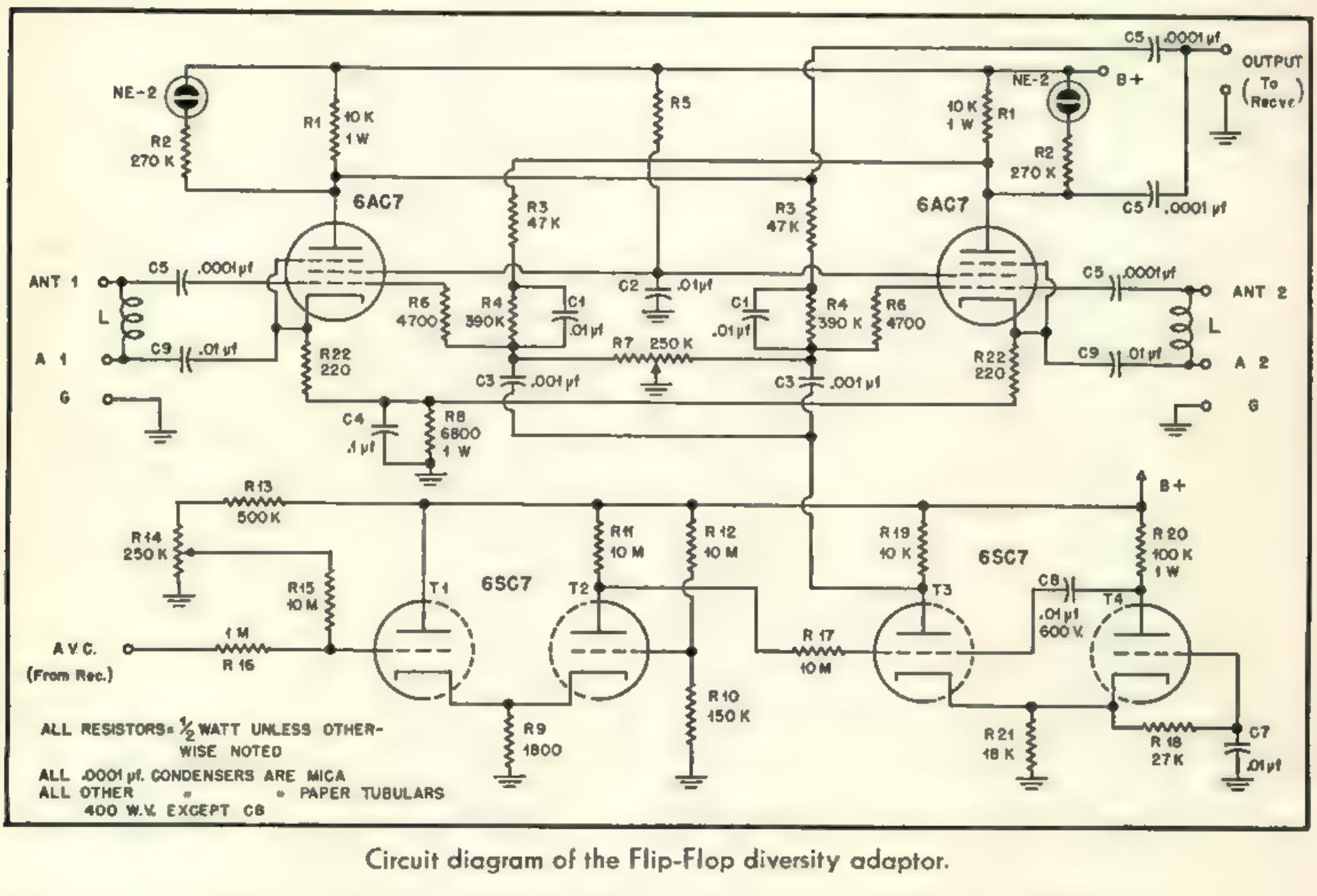
The voltage adjusting circuit contains a potentiometer which serves the dual purpose of compensating for the normal voltage present on the a-v-c system of various receivers and adjusting the level at which the a.v.c. stops the switch. For easy adjustment to suit various receiving conditions, this control is brought out on the front of the chassis.

Circuit Details

Two antenna input terminals are provided for each antenna system. A balanced feed line is connected to "ANT" and "A". An unbalanced antenna, such as a long wire, is connected to ANT and A is grounded. A coil of about 20 microhenries shunts the input to reduce the possibility of cross-talk from nearby broadcast stations. Its value is not critical and it may be omitted if no powerful stations are in the vicinity.

The impedance of the antenna connected to the Flip-Flop is not of great importance, but in general the higher the impedance, the more the output of the unit. Any frequency from 3 to 30 megacycles will be passed by the 6AC7s without using any tuned circuits. If greater antenna selectivity or an improved signal-to-noise ratio is desired, a tuned circuit may be connected between ANT and A with A grounded, and inductively coupled to the antenna feed lines.

The r-f signals on the 6AC7 grids are blocked off



Circuit diagram of the Flip-Flop diversity adaptor.

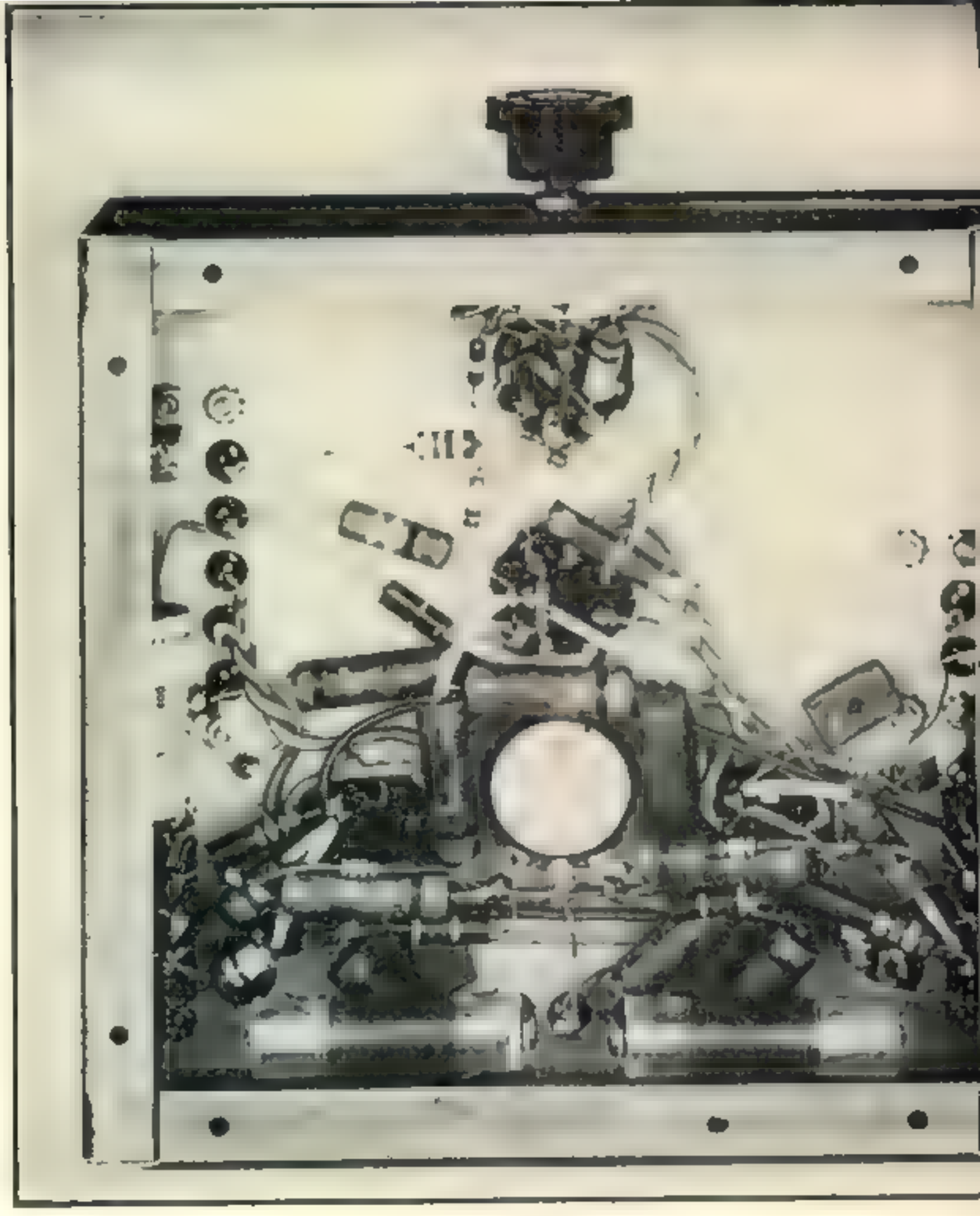
C1, C2, C6, C7—.01 µf, 400 v. tubular.
C3—.001 µf, 400 v., tubular or mica.
C4—.1 µf, 400 v., tubular.
C5—100 µµf, mica.
C8—.01 µf, 600 v. tubular.
R1—10,000 ohms, 1 w.
R2—270,000 ohms, ½ w.
R3—47,000 ohms, ½ w.
R4—390,000 ohms, ½ w.
R5—2700 ohms, 1 w.
R6—4700 ohms, ½ w.
R7, R14—250,000-ohm potentiometer.
R8—6800 ohms, 1 w.
R9—1800 ohms, ½ w.
R10—150,000 ohms, ½ w.
R11, R12, R15, R17—10 meg., ½ w.
R13—500,000 ohms, ½ w.
R16—1 meg., ½ w.
R18—27,000 ohms, ½ w.
R19—10,000 ohms, ½ w.
R20—100,000 ohms, 1 w.
R21—18,000 ohms, ½ w.
R22—220 ohms, ½ w.
L—20-microhenry choke, or 50 turns of No. 30 enameled wired on 9/16 inch form, spaced by wire diameter. Exact value not critical.

from the d-c feedback path by *R6*. The 6AC7 screens are connected together and fed from a common dropping resistor *R5*, with by-pass *C2* to ground. The plate resistor, *R1*, represents the d-c load on the tube, and the r-f load is the antenna coil of the receiver, coupled through the blocking condenser *C5*. The antenna input impedance of most receivers is about 300 ohms, so that a voltage gain of about 3 is obtained through the 6AC7.[1] A small neon bulb with a limiting resistor is connected across each 6AC7 plate resistor and serves to indicate which antenna is being used at any moment. These bulbs are mounted through the chassis in rubber grommets near the proper antenna terminals and associated amplifiers.

The d-c feedback circuit to obtain the flip-flop action in the 6AC7s is comprised of *R3*, *R4* and part of *R7*. *R3* serves mostly to block the r-f plate signal from the feedback circuit. *C1* is the "memory" condenser, which by its charge and discharge through *R4* assures that each pulse will reverse the conduction conditions of the 6AC7s. Occasionally two 6AC7s of quite different d-c bias requirements are found. To compensate for that condition *R7* is made adjustable and can always be set so that proper flip-flop operation is secured. The setting is not critical, and, once adjusted, further adjustment will be necessary only when changing tubes. Since the 6AC7 grid potential is held positive with respect to ground by the resistors in the feedback circuit, the 6AC7 cathodes must have a larger than ordinary resistor. This resistor is *R8*, by-passed in the usual fashion by *C4*. *R22* is a blocking resistor for r-f signal on the cathode when balanced antenna input is used.

In the 6SC7 pulser tube, negative pulses are produced across *R19* in the plate return of one triode. These pulses are fed to both 6AC7 grids through coupling condenser *C3*. Condenser *C3* and the portion of *R7* between each 6AC7 grid and ground serve as differentiators. Most of the time triode *T3* is cut off, and the long time constant combination of *C8* and *R17* allows the grid to return gradually to operating potential. As soon as *C8* has discharged sufficiently to start conduction in *T3*, the cathode potential starts to rise across the cathode resistor *R21*. The grid of *T4* is held at the average cathode potential by *C7*, and hence a rise of voltage on the common cathode caused by current in *T3* tends to decrease the current in *T4*. As the current decreases in *T4*, its plate voltage rises sharply, and *C8* pulls the grid of *T3* even further positive. This process continues until *T4* is cut off and *C8* has been charged by grid current in *T3*. Then the process reverses, and the grid of *T3* is carried far negative by the accumulated charge on *C8*. This whole process takes place in less than a millisecond, and the circuit must wait until *C8* discharges through *R17* to repeat.

Whether the grid of *T3* returns to operating potential depends upon the d-c voltage at the other end of *R17*. This end is connected to the plate of *T2*, part of the cathode-coupled 6SC7 d-c amplifier. *T1* serves as a cathode follower and *T2* is employed as a grounded grid amplifier. A small negative voltage from the receiver a-v-c system impressed on the grid of *T1* causes a much larger negative change on the plate of *T2*. This change is enough to prevent the grid potential of *T3* from returning far enough positive to start another pulse. This presence of a signal in the receiver, as indicated by a-v-c action, stops the switching action in the 6AC7s and enables the signal to come through. The combination of *R13*, *R15*, *R16* and potentiometer *R14* allows the exact potential of the plate of *T2* to be adjusted to compensate for whatever bias may be normally present on the receiver a-v-c system, and to set the sensitivity of the pulse-stopping action at any level desired.



The relative simplicity of the Flip-Flop is shown in this under-chassis view. Parts placement is not critical.

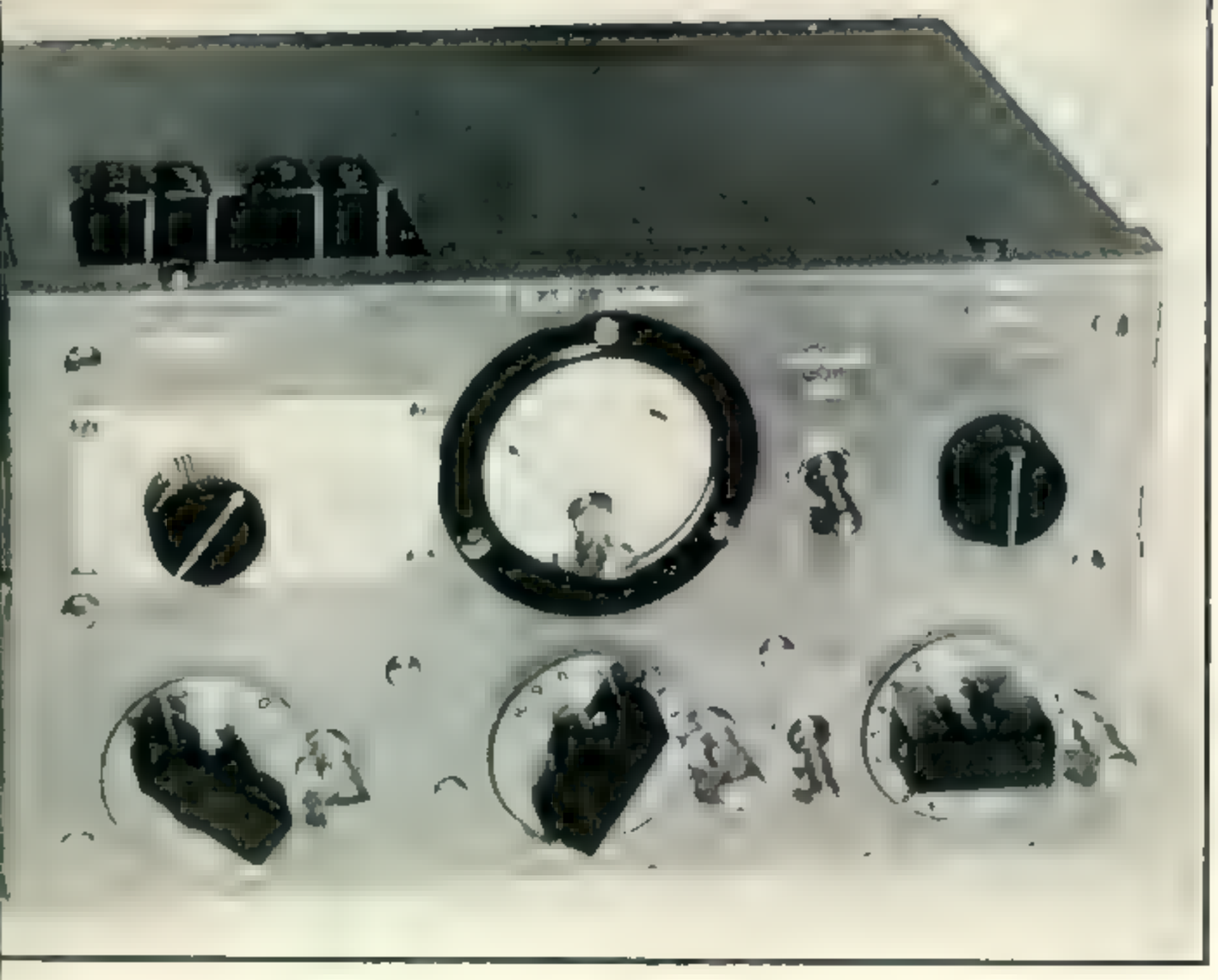
The filament circuit requires 6.3 v. a.c. at 1.5 amperes. The plate supply may be any voltage between 200 and 300 v. d.c. and draws about 15 ma. The 6SC7 tubes draw very little current. Most of the 15 ma is used in the conducting 6AC7. The plate and filament power can usually be drawn from the communications receiver, unless it is a small economy model, or runs with the power transformer pretty hot.

Putting It Into Operation

The Flip-Flop may be tested for proper operation with only the tubes in place and the power leads connected. Turn the sensitivity control (*R14*) to the ground end and set the balance control (*R7*) near the middle of its range. Turn on the power and watch the neon bulbs as the set warms up. One bulb should be on and one off. Turn up the sensitivity control until a regular flickering is noticed in the neon

(*Continued on page 88*)

1 The r-f load also includes the sum of the output capacities of the 6AC7 and the capacity to ground of the lead from the output terminal of the Flip-Flop to the receiver antenna coil. Accordingly the inter-connecting lead should be made as short and direct as possible if the gain indicated by the author is to be obtained—especially at the higher frequencies.



Crystal switching with the units accessible through a cabinet opening provide rapid QSY. Dial locks are provided for all controls.

◆

HARRY R. HYDER, W3NVL*

◆

Bandswitching

PORTABLE CW TRANSMITTER

80, 40 and 20 available at the flip of a switch on this lightweight transmitter designed for minimum battery drain.

WEBSTER DEFINES "portable" as "that which may be easily carried or moved." To the author, "portable" means capable of being carried or moved by one man, not equipped with means of locomotion other than the normal complement of two manual and two pedal extremities. When "portable" is used to describe a radio transmitter it should also mean independent of the normal sources of power, and requiring only a rudimentary antenna. So while planning a portable rig, the following specifications were written, and rigidly adhered to. These specifications were:

1) The rig should be as small and light as possible.

2) It should be capable of operation on the 3.5, 7, and 14-mc bands with no plug-in coils, and should be capable of being switched to at least four crystal frequencies in each band.

3) It should have two stages: crystal oscillator and amplifier.

4) It should be capable of being coupled to an antenna of random length.

5) It should operate from a 6-volt storage battery, and a 300-volt 100-ma vibrator power supply.

6) The standby current drain should be zero.

7) The rig should present a pleasing appearance.

A little thought and much thumbing through handbooks and tube manuals enabled us to meet all of the above conditions.

The Circuit

The use of instant-heating tubes is not common in equipment, since they are slightly more expensive than the heater-cathode types; but it has been proven in commercial service that a transmitter using instant heating tubes consumes only about 10% of the power drawn by one using indirectly heated tubes, when averaged over long operating periods . . . and battery-chargers are not usually available during emergencies. Two of RCA's newest tubes are used. The oscillator is a miniature 5618 and the amplifier a 2E24. Even when transmitting, the total filament drain of these two tubes is less than 1 ampere.

The crystal oscillator always works "straight through," as this circuit is likely to give the least trouble in the field. The oscillator plate tank circuit will comfortably tune both the 3.5 and 7-mc bands as a fairly large, 300-$\mu\mu$f tuning capacity is used. The 2E24 amplifier circuit may be operated as either an amplifier or doubler with almost equal efficiency. Carbon resistors of 22 ohms are used in the grid and screen leads to preclude any oscillation troubles, which happily did not turn up. The amplifier plate tank circuit is a simple shunt-fed pi-section filter. Almost any type of antenna can be made to take power with the proper adjustment. Also, this type of circuit gives greater harmonic attenuation than an ordinary parallel circuit. The plate tank coil is wound on one form in three sections; a switch shorting out appropriate sections for operation on the three bands. A SPST switch is placed in the 2E24 screen lead. When this is open, the oscillator may be adjusted independently of the amplifier.

A great deal of thought was given to the type of keying to be used. Blocked-grid keying was finally chosen, as this gives the maximum protection to the tubes, the power broken by the key is very small, hence no relay is necessary; and it gives nice clean keying. While a 90-volt C battery is required, this can be a midget type, as the drain is negligible and

* *c/o Dept. 63, Bendix Radio, Baltimore 4, Md.*

he battery service should be limited only by its shelf life.

Construction

Since the performance of the rig depends greatly on its construction, this will be gone into in some detail.

The case is a standard 5" x 6" x 9" steel utility box, the 5" x 9" face being the front panel. No suitable chassis was available on the market, so one was built up of .020" sheet steel, and cadmium plated. Aluminum would be just as good electrically and somewhat easier to work, but cannot be readily soldered. The two interstage shields, one above and one below the chassis, are made of the same material. The back drop of the chassis is a strip of bakelite, which makes a convenient terminal board.

The crystal sockets are mounted on an L-shaped bracket fastened to the left-hand side of the front panel, above the chassis. The crystals protrude through a clearance hole cut in the top of the can, and can be removed without taking the unit out of the cabinet. The four crystals plug into two octal wafer sockets. Rather than punch the usual 1¼" clearance hole for the sockets, ¼" diameter holes were drilled over the appropriate prong holes of the sockets. In this way, it is impossible to insert the crystals incorrectly. The crystal switch is mounted directly under the L-bracket, as are also the grid leak, choke, and key by-pass condenser. Most of the remaining parts, except for the tubes and coils, are placed under the chassis. The by-passes are triple .1-μf 600-volt bathtub condensers, of the type which mount above the chassis with their terminals projecting downward. The socket for the 2E24 must be submounted about ¾" to give its plate cap adequate clearance from the top of the can. The 2E24 plate r-f choke is mounted on a small ceramic pillar close to the tube, with its top lead and the 2E24 plate lead joining the upper terminal of the plate blocking condenser, which is mounted on the shield partition with ceramic pillars.

The oscillator coil is wound on a 1¼" form. In the development of this rig, it was more convenient to make this coil plug-in, so that it could be easily removed for pruning; but it could just as well be permanently mounted. The coil consists of 14½ turns of No. 18 DSC, close wound. The amplifier coil is wound on a piece of phenolic tubing 1½" diameter and 4" long. The wire is No. 18 bare tinned copper. First, along a straight line drawn down the form, drill 4 No. 27 holes; two ¼" from each end; one 1¼" from one end of the form, and one 1½" from the other end. It is also helpful, but not necessary, to drill 5/16" diameter holes diametrically opposite these holes. Then insert No. 6-32 screws through the No. 27 holes, with the heads on the inside of the form and the shanks projecting outwards. The two center screws should be ½" long. Secure the screws with nuts and lock washers. Then the winding may be started.

About 30 feet of wire is needed. Hold one end

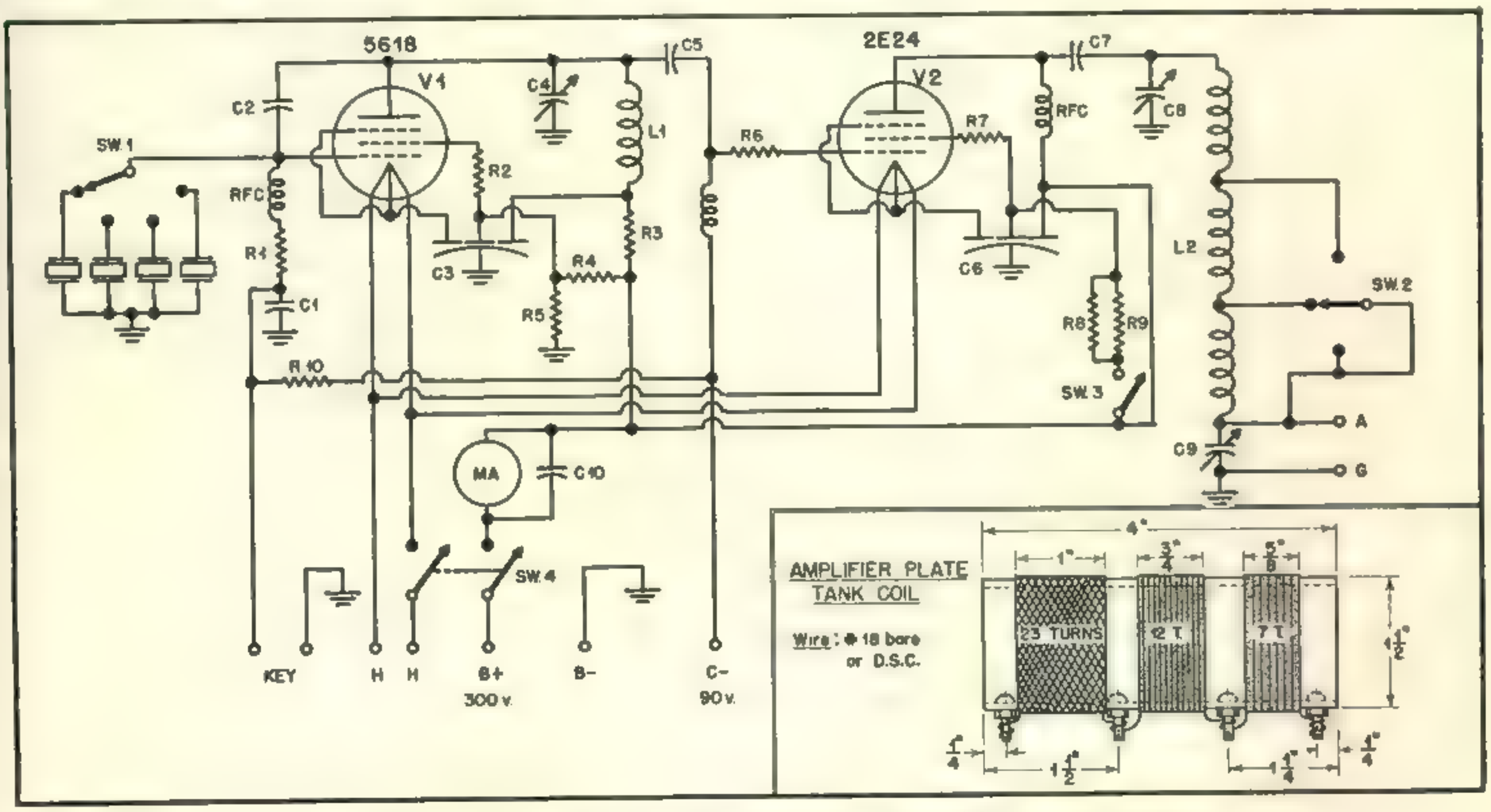
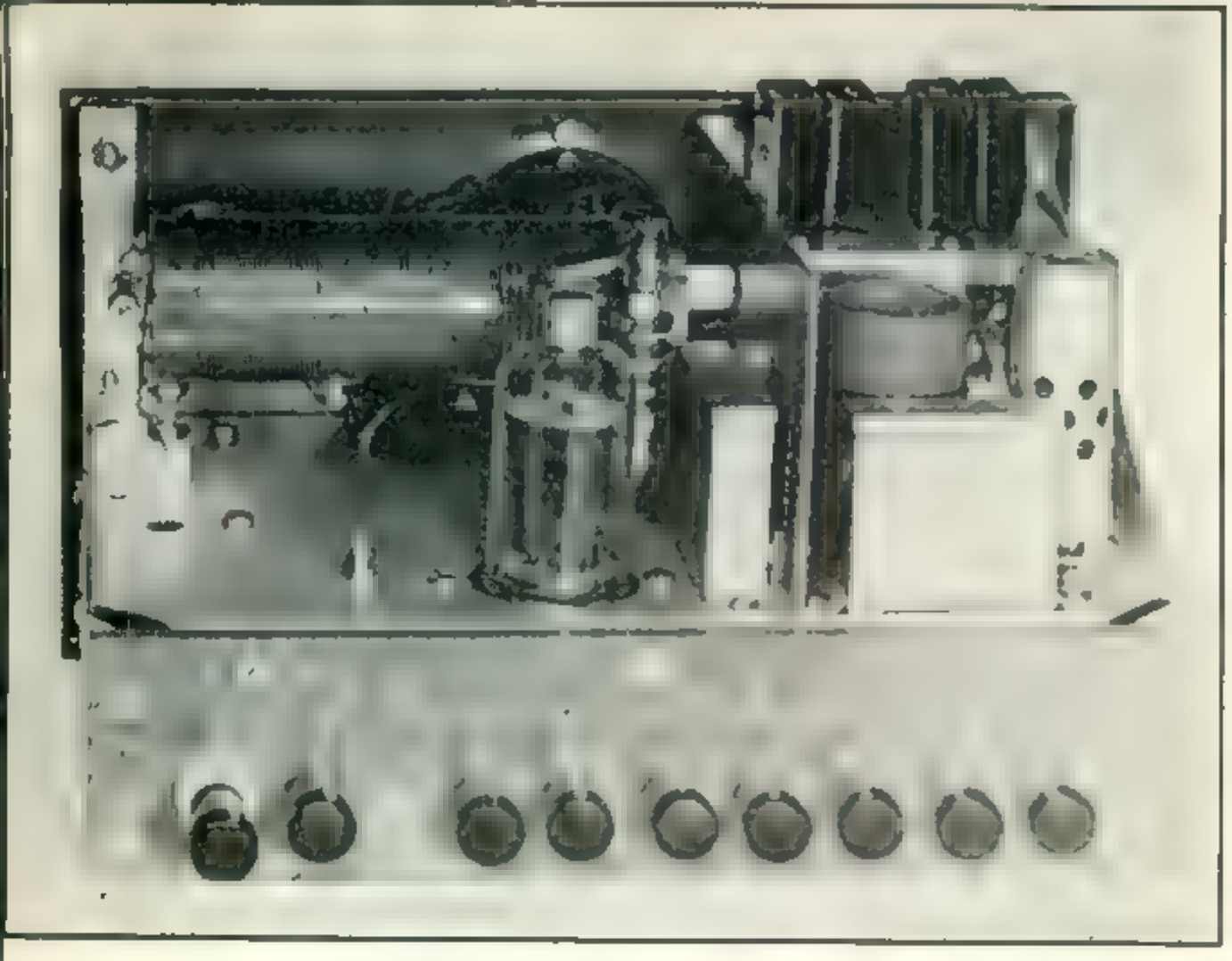


Fig. 1. Circuit of the complete bandswitching portable c-w transmitter.

C1, 10—.01 μf, 600 v., paper tubular.
C2—2.2 μμf, 500 v., ceramic.
C3, 6—.1-.1-.1 μf, 600 v., paper.
C4,8,9—300 μμf, receiving-type variable (Bud).
C7—.001 μf, 1000 v., mica.
R1—47K, 1 w., carbon
R2—22 ohms, ½ w.
R3—2200 ohms, 2 w.
R4—15K, 2 w.
R5—22K, 2 w.
R6,7—22 ohms, 1 w.
R8,9—22K, 2 w.
R10—100K, ½ w.
RFC—2.5 mh, r-f choke (National R-100).
SW1—Single-pole 4-position rotary.
SW2—Single-pole 3 position ceramic rotary.
SW3—SPST toggle switch, heavy duty.
SW4—DSPT toggle switch, heavy duty.
M—0-100 d-c milliameter.
V1—RCA 5618
V2—RCA 2E24
Cabinet, chassis, sockets, knobs, dials, misc. hardware, etc.



The transmitter with dust cover removed. The individual tank coils wound on a common form are clearly visible. Pushbutton terminal-type binding posts are used for all input circuits. The antenna post is mounted on a ceramic feed-through bushing.

of the wire in a vise, or wrap it around something solid. Wrap the other end of the wire several times around the first screw, close to the nut, and solder it. Straighten the length of wire by stretching it slightly. Then, wind the first section of the coil, walking towards the vise and maintaining even tension on the wire. The first section consists of 23 turns, spaced to a length of 1". Wrap the wire several times around the second screw and proceed with the second section. The second section has 12 turns, spaced to a length of ¾". Wrap the wire around the third screw and proceed with the third section. This is 7 turns spaced to a length of 5/8". The wire should then be wrapped around the final screw and the excess clipped off. The wire should be soldered to the screws. If the turns have come out unevenly, they may now be adjusted with a small screwdriver or scriber. The finished coil should be liberally coated with Q-Max, or other low-loss dope, and allowed to dry for a day or so. The entire procedure is not as complicated as it sounds, and anyone with any coil-winding experience should have no trouble. Small ceramic pillars are threaded to the end screws and used for mounting on the chassis. Leads from the intermediate taps go to the bandswitch. A drawing of the coils is given.

The modern ham is not satisfied with the "haywire and nails" of a bygone day; the days when to get a rig working was a feat in itself, much less dressing it up. The parts manufacturers, sensing this trend, have brought out lines of very attractive knobs, dials, cabinets, and accessories. With all these aids, any ham can turn out equipment rivaling manufactured gear in appearance. The panel and chassis of this rig were laid out with both symmetry and electrical efficiency in mind; and with a little juggling a layout was achieved which obtained both at the sacrifice of neither. The three tuning controls are mounted on the lower portion of the panel and fitted with National type "R" dials and Millen dial locks. The crystal switch is novel: a 1½" x 3" escutcheon was made from two pieces of thin aluminum with a piece of celluloid sandwiched between. The switch is mounted at one end of the escutcheon and a 1" square hole cut in the outer sheet at the other end. On the inner sheet, a slot is cut directly under the 1" square hole. The frequencies of the four crystals may be printed or typed on a slip of paper and inserted in the slot. The switch knob is orientated so that its pointer points to the printed frequency corresponding to the switch position. The outer piece of aluminum is polished with fine sandpaper and given a coat of clear lacquer or white shellac. This finish closely resembles that of the tuning dials.

After the front panel was drilled, the controls were marked with the decalcomanias put out by the James Millen Co., and when dry, brushed over with clear lacquer to insure permanence of the lettering. While all of these refinements take time, they are worth while to any amateur who takes pride in the appearance of his equipment.

Power Supply

While the transmitter will operate from any 300-volt 100-ma power supply, some types are more suitable than others. There are several types of vibrator power supplies on the market. The most satisfactory uses a synchronous vibrator, of the type that requires no tube rectifier. A Vibropack using an OZ4 or other gas rectifier *cannot* be used, since the gas rectifier requires a minimum starting load of about 50 ma, and the key-up drain of this rig is only about 15 ma. At this station, we had a Vibropack using a 6X5 rectifier available. The 6X5, being indirectly heated, had to be run continuously. In casting about for a way to eliminate this drain, we hit upon the idea of replacing the 6X5 with selenium rectifiers. These rectifiers are used in many modern broadcast sets, and give good, trouble-free service. They have low voltage drop and stand up well under momentary overloads. Also, they are inexpensive. The 6X5 was replaced with six 117-volt 100-ma selenium rectifiers, arranged in two sets of three series connected rectifiers. A 33-ohm resistor was put in series with each set, to limit the peak current. Each set replaced one plate of the discarded 6X5. They have given

TABLE OF VOLTAGES AND CURRENTS

Key Up Readings:

Total plate and screen current	15 ma.
Amp. plate voltage	400 v.
Amp. screen voltage	250 v.
Osc. plate voltage	350 v.
Osc. screen voltage	175 v.

Key Down Readings: (Resonated and Loaded)

Amp. plate voltage	300 v.
Amp. screen voltage	200 v.
Osc. plate voltage	275 v.
Osc. screen voltage	100 v.
Amp. plate current	50 ma.
Amp. screen current	10 ma.
Amp. grid current (actual)	4 ma.*
Osc. plate current	25 ma.
Osc. screen current	5 ma.

* See text.

Osc. screen voltage divider draws approximately 7 ma.

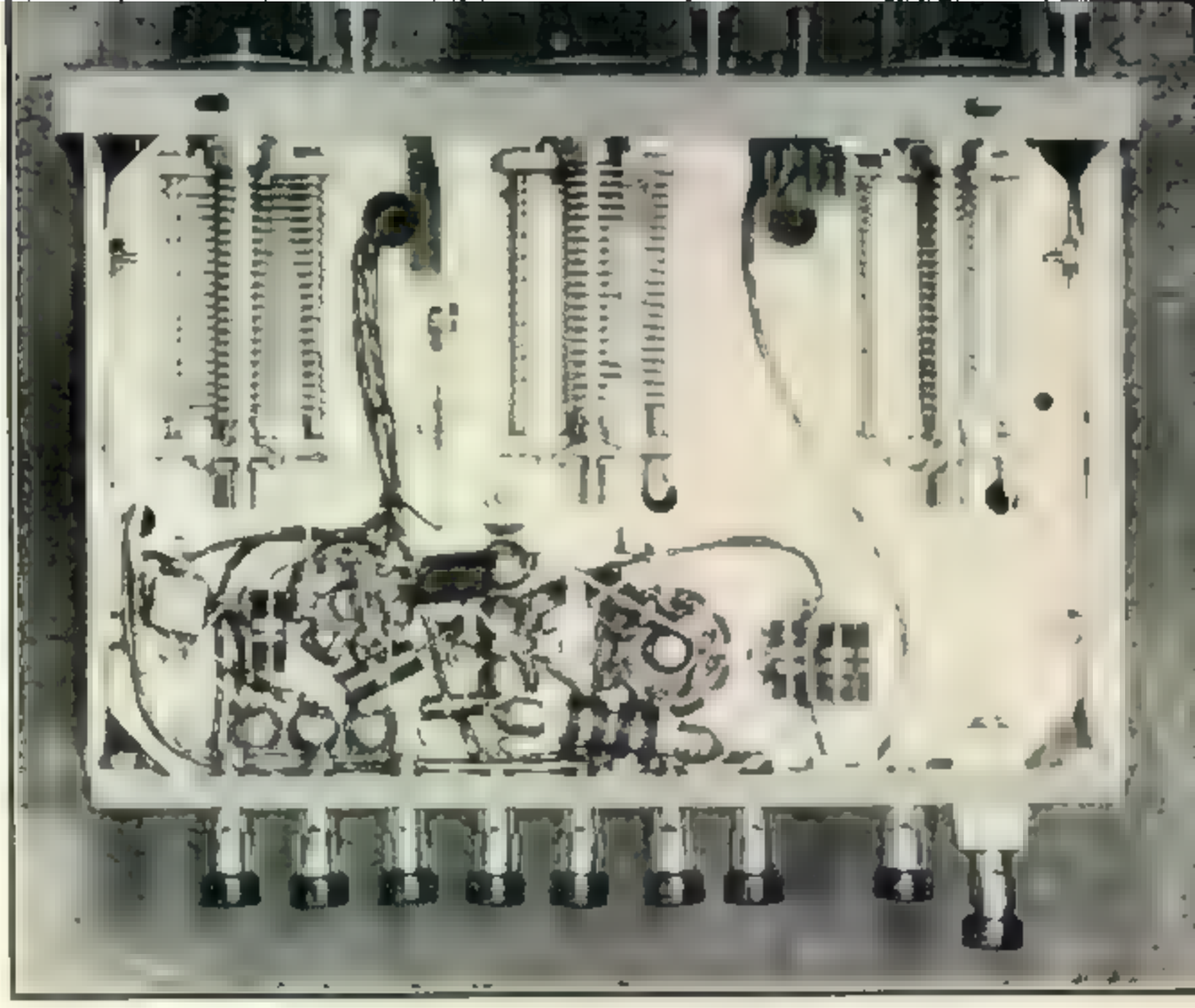
Drain from 6.6-v. storage battery when key is down is about 8 amps.

excellent service and show no signs of deteriorating. The rectifiers used were Federal type 403D2625. A dynamotor is also well adapted for this type of operation, but is slightly less efficient and costs more initially.

Operation

After the rig has been completed, either the vibropack or an a-c power supply may be hooked up and the rig tested. One note of warning: the tube manufacturers do not recommend continuous operation of the filaments of these tubes, as this shortens their life greatly; so when the rig is used for home-station operation, it is wise to keep the filaments lighted only during transmission. The front-panel power switch removes both plate and filament voltages simultaneously. The antenna may be any convenient length, but a longer wire will give better results. If the wire is appreciably shorter than a half wavelength at the operating frequency, a good ground should be used. A 0–10 ma d-c meter should be connected in series with the C battery for initial testing. The plate current meter reads total power supply current. With everything connected, the tuning switch should be opened and the power turned on. With the key up, the current should read about 10 ma. With the key down, the current will rise to about 60 ma. Tune *C4* for a dip. With 3.5-mc crystals, the dip should occur with *C4* near maximum. With the 5618 oscillating, the plate current should be 35–40 ma. Next, close *SW3*, the tuning switch, and with *C9* at maximum capacity press the key. The meter will probably go off scale, but when *C8* is resonated, will drop to about 60 ma when the 2E24 is working "straight through" and 70 ma when the 2E24 is doubling. To load the antenna, *C9* should be decreased in small steps, restoring resonance with *C8* after each adjustment. As *C8* is decreased, the minimum plate current will become greater and greater, indicating that the antenna is beginning to load the tank. When the minimum plate current is 100-ma total, the loading is complete. The rig should key cleanly with no traces of clicks or chirps if all the specified values are used. A great deal of time was spent arriving at the proper operating conditions. Since the low grid-plate capacity of the 5618 prevented some crystals from keying well, or oscillating at all, this was augmented by an additional 2.2-$\mu\mu$f ceramic condenser. A "gimmick" could be used as well. No parasitics turned up, probably due to the liberal use of suppressor resistors. Absolutely no traces of instability turned up in the amplifier, due to the adequate shielding and by-passing. The 2E24 indicated grid current should be about 3 ma; actual grid current is 1 ma greater than this, due to the reverse current drain from the battery through *R10* when the key is down. A table of voltages and currents is given for the convenience of anyone copying the rig.

All in all, the rig was a decided success and did all that was hoped for it. It can be tucked in a suitcase for a vacation trip, used for emergency drills and field days, and is always ready for the emergency which we hope never comes but sometimes does. It was designed as a companion unit to the regenerative receiver described by the author in *CQ* for October, 1947. An entire station, consisting of transmitter, receiver, vibropack, one of the small 6-volt storage batteries available on surplus, and a coil of antenna wire, can be packed into a small carrying case and easily transported and set up by one man.



Under-chassis view of the transmitter. Resistor, capacitors, and r-f chokes are grouped around the sockets. Note that the rear wall of the chassis is made of bakelite eliminating the need for individually insulating the binding posts.

Postscripts

Quarter Century Wireless Assn.

Very favorable response has greeted the Quarter Century Wireless Assn., according to its president, John DiBlasi, W2FX, with the following new members having joined since the last meeting: W2LKN, W2AS, W2PYY, W2KU, W2ILO, W2DDA, W2BNY, W2GKB, W2IXE, W2QF, W2BKY, W2MIN, W2DI, W2VH, W4IE, W6YYU, W9NN, and W9RNF. Roster lists and membership cards will shortly be mailed to all members. Any amateurs interested in joining the association should communicate with W2FX or W2FIT.

Ham Radio Saves Boy's Life

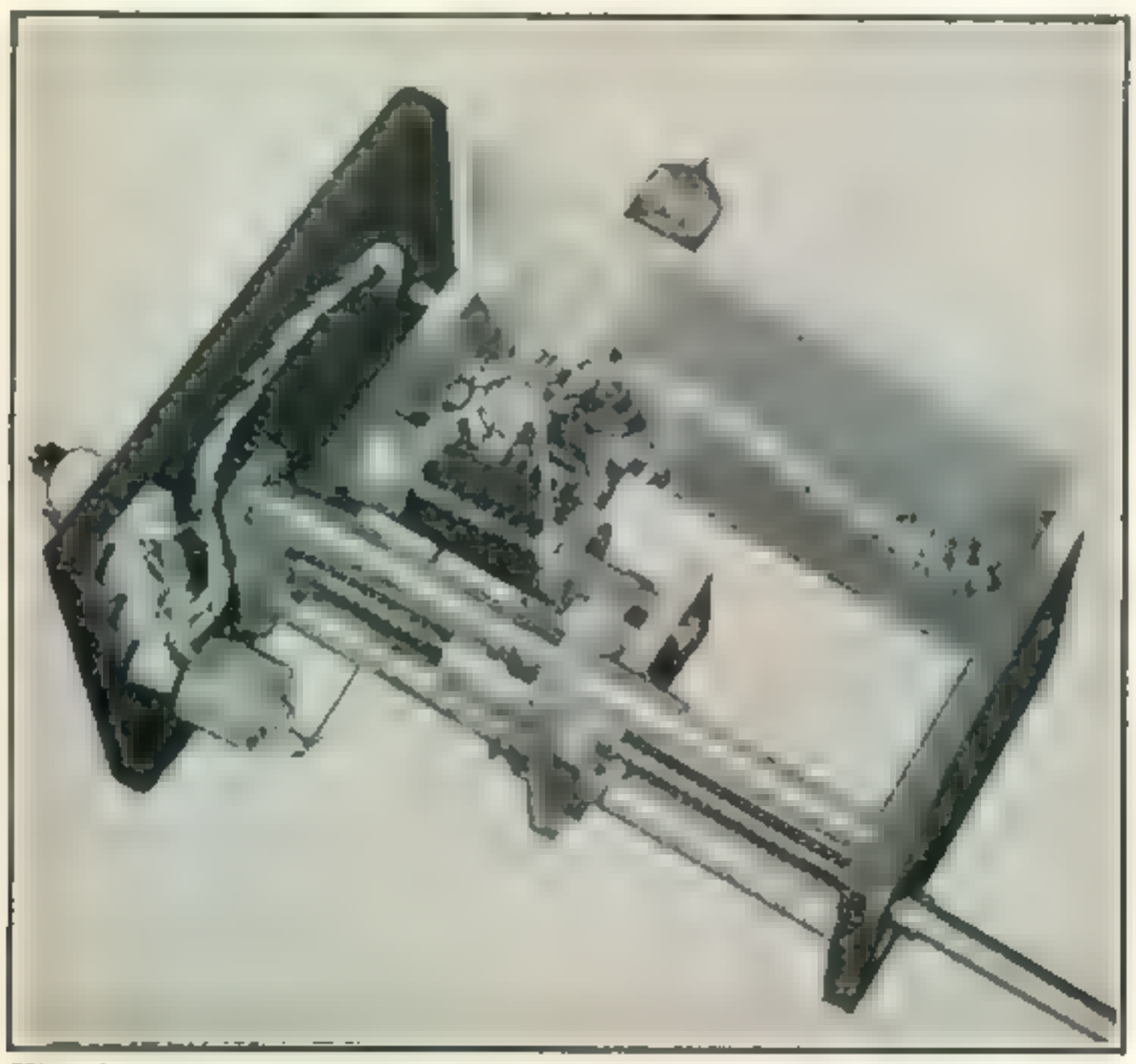
Ham radio "did it again" on Friday March 12 when an emergency call from CE2BQ in Chile was picked up by Hank Lockwood, W2HFS, at Hartsdale, N. Y., to save the life of a 16-year old boy. W2HFS, who had been observing quiet hours for TVI, answered the call and was told that the boy was desperately ill and the only chance of saving his life was in the immediate procurement of streptomycin, which was not available in Chile. Before he could get the details of the illness, or the QTH, the signals faded. Hank called a friend on Long Island, Stanley Foster, chief accountant of Pan American Airways, and he and PAA Flight Radio Officer Cliff Evans (ex-EL4A) got ten vials of the drug on a midnight plane to Santiago. W2HFS cabled CE2BQ to meet the plane, and on Monday when radio contact was again established, CE2BQ reported that the boy, who had been suffering from a streptococcus infection, was already responding well to the streptomycin. This is another example proving that through no other medium could such an urgent appeal from a private citizen in a foreign country get such a quick and helpful response.

COMMENTARIES • • •

A Department of Technical Discussions

Permeability-Tuned V.F.O.

ALTHOUGH THE USE of powdered iron cores as a method for changing the resonant frequency of circuits has long been accepted and used commercially, to date the amateur fraternity has not adopted it widely. The major reason apparently is the difficulty of obtaining a satisfactory mechanical arrangement for moving the core. This article is intended as an aid to those who have contemplated building a permeability-tuned self-excited oscillator. The equipment described was built without any special tools other than a drill press.



The lead screw drives the core in the permeability-tuned oscillator.

Mechanical Details

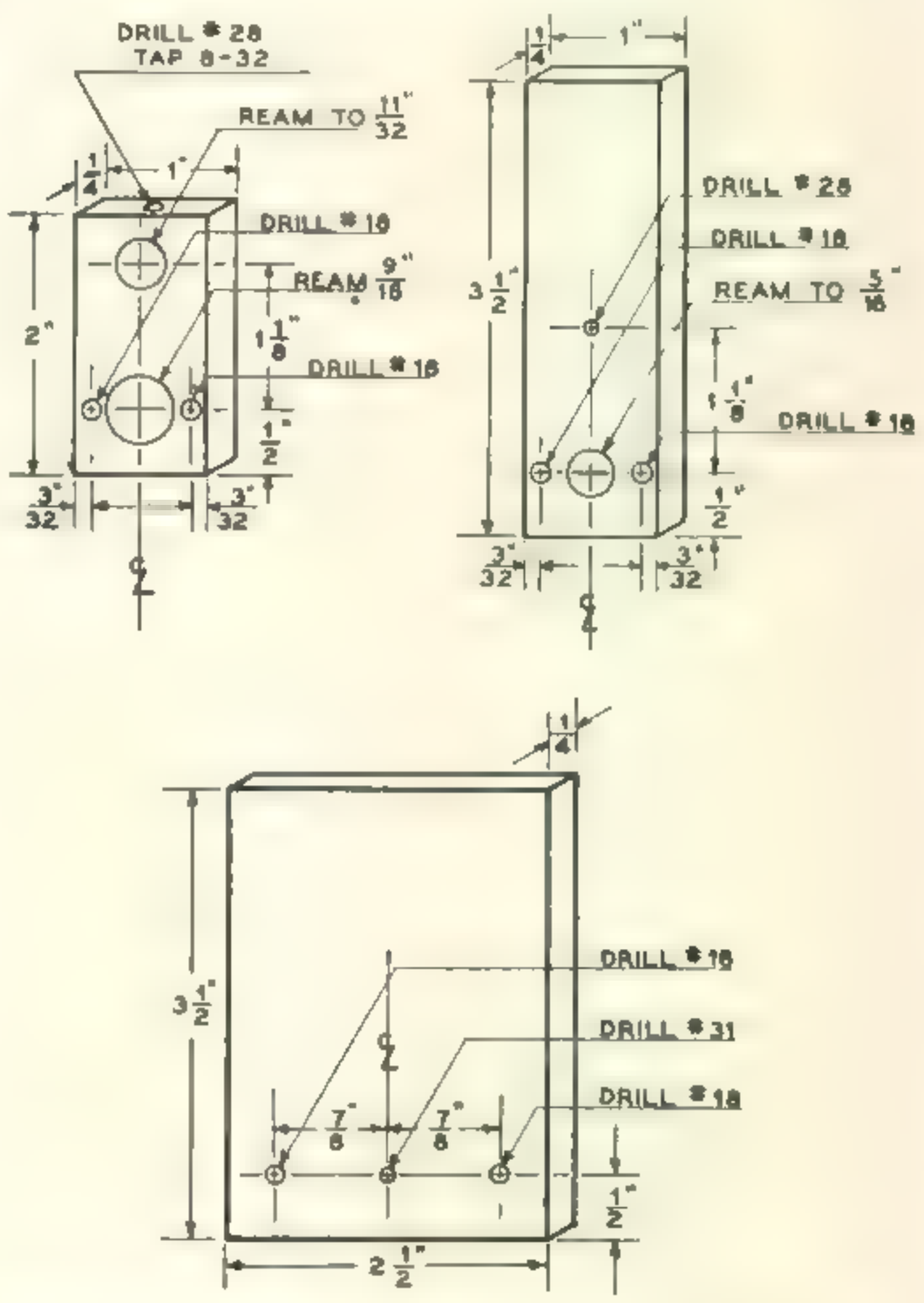
In building the oscillator, maximum attention was given to mechanical construction. The heart of the mechanical system of course is the lead screw core-driving mechanism. The writer was able to obtain an adjustable parallel line tank circuit for a 10-cm oscillator in surplus for less than a dollar. It was then converted to a permeability tuner. The lead screw drive for the core has inherent vernier action so that five turns of the shaft cover the range of 1750 to 2000 kc.[1] This means that the dial has to have a one-to-one shaft available at the rear for coupling to the oscillator slug shaft, plus its own vernier scale for logging purposes. An advantage is seen here in that the driving mechanism for the dial is unloaded, thereby reducing the possibility of slippage. A dial from a BC654 transmitter-receiver unit was used, having a one-to-one shaft and dial, with a counter at the top. The combination works extremely well. Millen makes a dial of this type which is also quite suitable. Quarter-inch brass was used for all supports although other metal of a lighter guage can be successfully employed. All the wiring in the oscillator circuit outside of resistors, condensers and heater leads, is No. 14 wire. The oscillator, as can be seen in the photos, is completely enclosed in a metal box. The unused socket at the top is provided for eventual inclusion of a narrow-band FM modulator. The hole at the rear is for the audio input connection.

[1] With the L-C ratio chosen for the oscillator.

Electrical Details

The next problem was the choice of oscillator to cover the range of 1750 to 2000 kc. The trial and rejection method finally narrowed the search down to the two-terminal cathode-coupled oscillator. It provides easy adaptability to circuit and mechanical design because of its two-terminal coil and has excellent keying characteristics, keyed in either a negative or positive supply lead. The 6J6 dual triode was chosen as the oscillator tube because of its short internal connections and small mass with consequent small vibration capability. This oscillator, plus the use of an iron core, presents a very high order of stability with regard to mechanical shock and vibration. The condenser is also a poor performer as regards temperature coefficient and shows up badly when subjected to high humidity.

The buffer, not appearing in the photograph, is included with the following exciter stages of the transmitter. The 6AK5 used in the buffer was chosen because of its very high transconductance and performed well in the circuit shown. It was

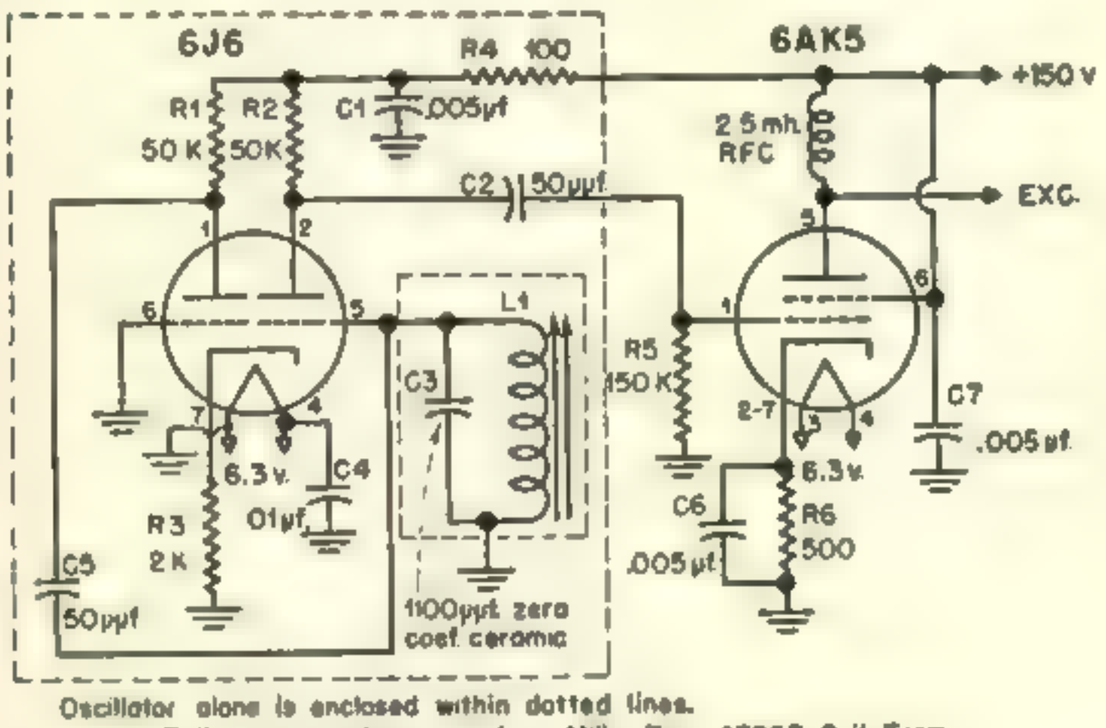


Mechanical details of the lead screw core driving mechanism.

found necessary for maximum stability of operation to separate the two stages with the coupling lead from oscillator output to buffer grid circuit not exceeding 6 to 8 inches. With 150 volts on both plate and screen of the 6AK5, the output is sufficient to light a ¼-watt neon lamp which is adequate to drive a 6L6 or 807.

Results of Tests

The oscillator removed from its box was set up using an ordinary unregulated 150-volt supply for plate voltage. The total current on the 6J6 was 2.5 ma. It was run for a period of five hours with hourly readings taken on a BC-221 frequency meter checked against WWV. While the stability plotted against time proved good the first two hours, the curve showed that some more work might be done in the way of compensation. This stability without



Oscillator alone is enclosed within dotted lines.
L1–27 T # 18 enam. close wound on Millen Type 47003 Coil Form
Tuned with transmitting type iron slug ⅜" in dia

Circuit diagram of the permeability-tuned v.f.o.

compensation is more than adequate for amateur application, however. The writer was looking, first of all, for a simple oscillator.

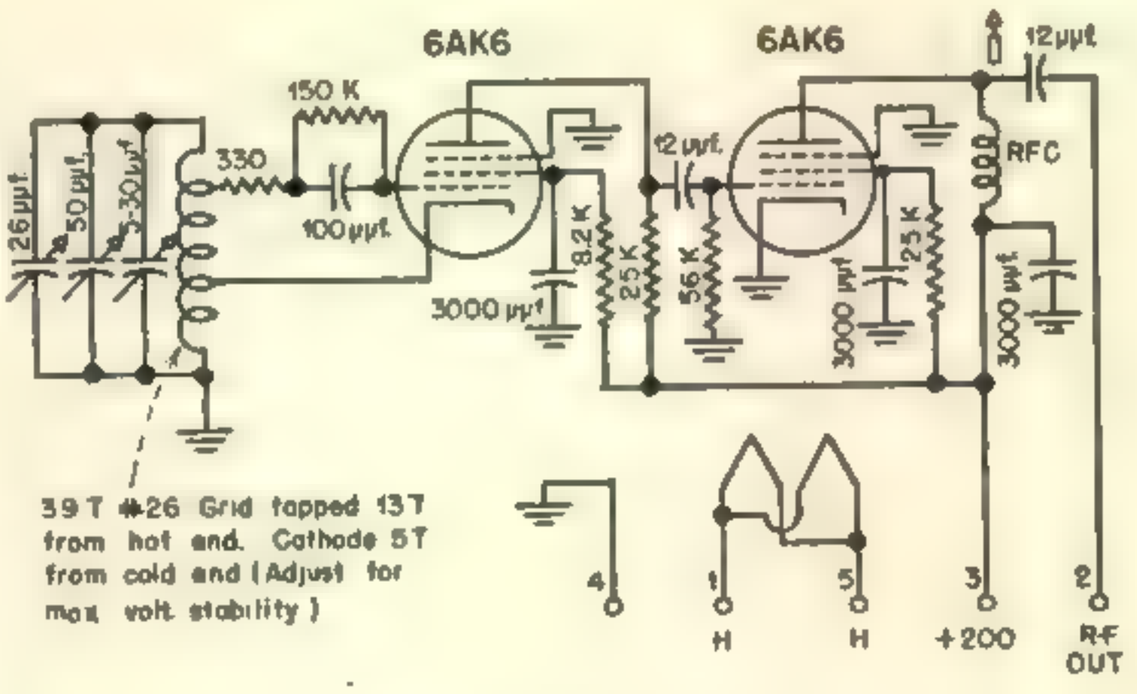
Owen J. McCabe, W1COJ

Simple Plug-in V.F.O.

THE FREQUENCY generated by an oscillator may be stabilized by paying careful attention to some fundamental considerations. First, the plate load of the oscillator should have a very low reactance. This lessens the tendency of the following circuit to pull the oscillator off the set frequency. Second, the coupling to the following stage should be kept as loose as possible, so as to lighten the load on the oscillator. Third, if a screen grid tube is used, the ratio between the screen and plate voltage is important in order that the effect of variations in power supply voltage upon the frequency may be kept to a minimum. Fourth, the ratio of cathode to grid inductance is critical and has a major bearing on the voltage stability. Fifth, the oscillator should be isolated from the driven circuit by a Class A stage. Sixth, a stiff tank circuit will minimize the effect of tube capacity change upon the frequency by lowering the ratio of the tube input to total circuit capacity.

There are several additional factors which must be taken into account, for example: Type of oscillator tube, coil form and winding, position of grid and cathode taps, type of padding capacitor, and temperature compensation.

The type of oscillator tube plays an important



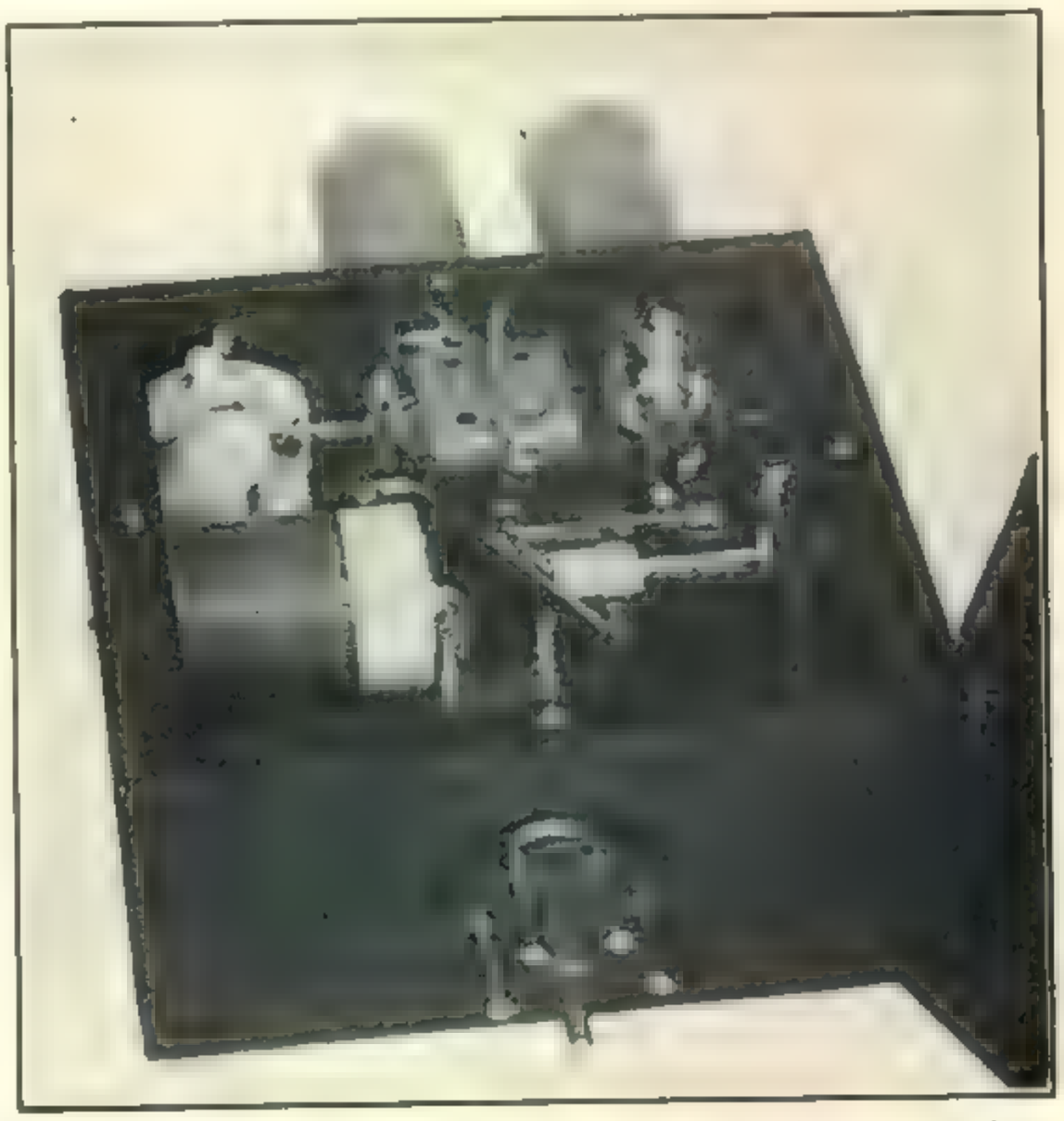
Circuit diagram of the plug-in v.f.o.

part and should be selected with care. Incidental to the selection of the best tube type, the socket should be made of a material with as small a dielectric and expansion constant as possible. First, the input capacity should be low because of the relative change of capacity from the cold to hot conditions. If the capacity is low, the relative change is small. Since the input capacity of the tube is across part of the tuned circuit, it is evident that as small a change as possible is most desirable so that the drift contributed by the tube be kept low. The new miniature tubes are outstanding in this regard. Generally, the input capacity of these tubes is lower than their larger counterparts and because they have no pin holders other than the glass base, one source of drift is automatically eliminated.

The inductance should be made sturdy and not subject to either mechanical or thermal shift. A grooved ceramic form is most desirable because it adds very little to the distributed capacity of the inductance and has a very small coefficient of thermal expansion. The wire used should be as soft as possible so that when the coil is wound, the wire hugs the form tightly in order that sudden jumps due to thermal expansion or contraction may be eliminated.

An optimum ratio exists between the grid and

(*Continued on page 91*)



Using miniature tubes the complete v.f.o. may be plugged into a standard 5-prong socket.

"OSCAR"—A Milliammeter for The Sightless Amateur

H. S. BRIER, W9EGQ,* And V. O. CHRISTMAN, W9WEU

An opportunity to put amateur radio within the grasp of physically handicapped individuals.

DID YOU EVER TUNE your transmitter with your eyes shut? Go ahead; try it. I'll wait. Well, you were going to replace that 304TL anyway.

Now you know the problem confronting the sightless ham. When W9PBS's new 350-watt phone and c-w transmitter was being built we discussed the problem of John's being able to tune it without depending on visiting hams.

Several ideas, such as using a relay to ring a bell, etc., to indicate resonance were discarded as being impractical, because the currents to be measured ranged from two milliamperes in the 807 grid circuit to 200 ma in the final amplifier plate circuit. Further complicating the problem was the fact that at some points resonance would be indicated by minimum current and at others by maximum current.

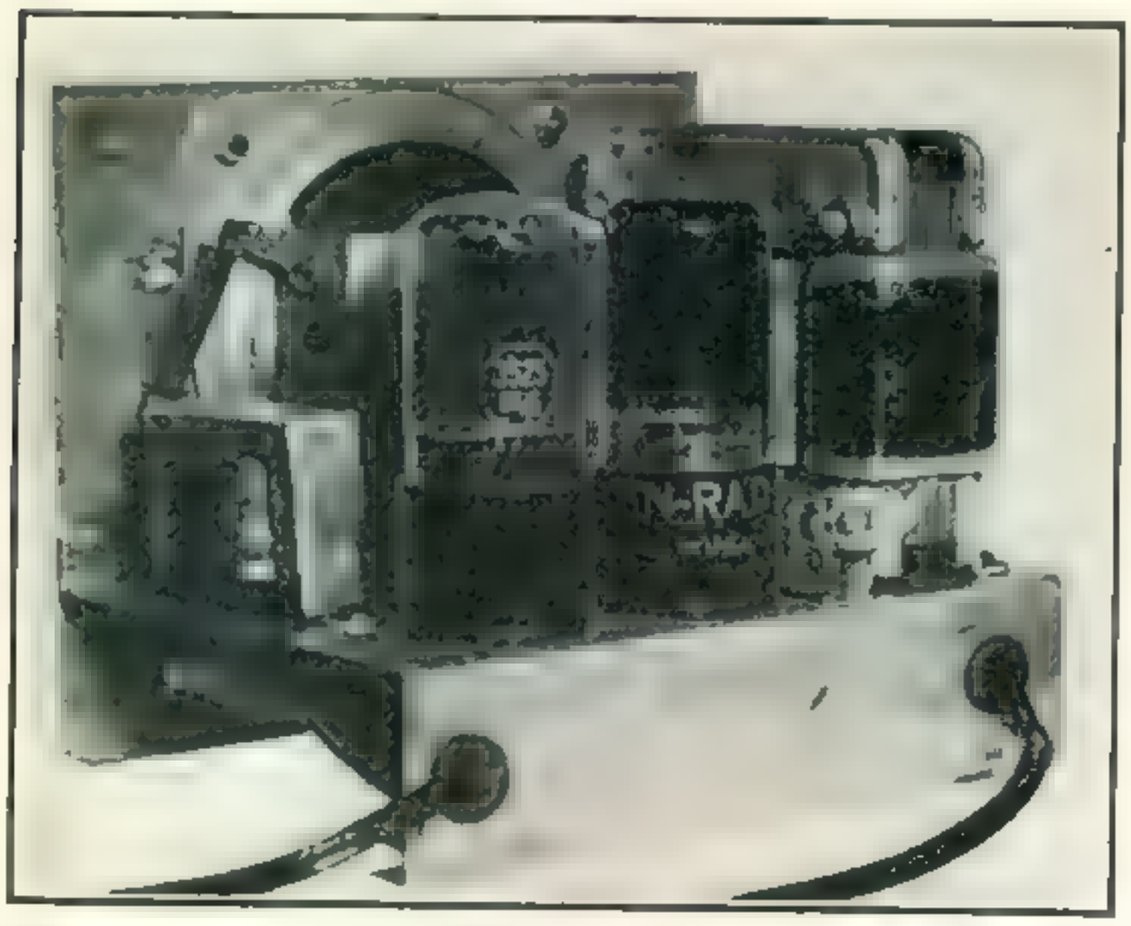
Could we feed 60-cycle house current through a saturable reactor to a speaker, and feed the current to be measured through the saturation winding? At no current the reactor would have maximum inductance and reactance, and the speaker output would be low. As the d-c current was increased, the reactance would decrease, and the speaker output would increase. This sounds good until one remembers that the human ear responds to power variation logarithmically. Even the trained ear cannot detect a variation in "loudness" of less than one db. A circuit rated at 100 ma could draw any current between 87 and 113 ma, and still be within one db of 100 ma. That idea was discarded!

Vic Christman, W9WEU, was killed last December in an automobile accident. Shortly before his untimely death he designed and built "Oscar" for W9PBS, a blind amateur. It shows the kind of ham Vic was—always ready to lend a hand where it was needed.

Suppose the pitch of a tone could be varied by a current change. The human ear can easily detect such a change of less than one-half per cent. We might use the a-c windings of the saturable reactor as the inductance in an audio oscillator. Increasing the current through the d-c winding would decrease the inductance, thereby increasing the frequency of oscillation. Our 100-ma circuit could then be tuned within one-half milliampere. The problem was solved.

The pictures and the diagram, *Fig. 1*, show how simply theory was converted to practice. The heart of the unit is the reactor, whose construction and dimensions are detailed in *Fig. 2*. Some prewar broadcast receivers used similar reactors as tuning indicators. The pilot-light current was run through one set of windings, and the d-c plate current of the tubes controlled by the a.v.c. through the other. Resonance was indicated by tuning for maximum brightness of the pilot light.

* *385 Johnson St., Gary, Ind.*



The homemade saturable reactor is visible on the right-hand side of the chassis.

Construction of the Reactor

One of these reactors might have been used if it had been available. It was not; so an ancient, 15-henry 100-ma filter choke was dug out of the junk box. Any similar choke can be used, if a practical method of mounting it with windings on all three legs can be devised.

The identical a-c windings on the outer legs are wound on forms made of a layer or two of gummed paper. Insulation between layers is Cellophane tape sold in ten-cent stores in 3-inch widths for trimming lamp shades. It is stronger and takes up less room (an important point) than paper. The finished coils are

liberally doped with household cement and allowed to dry.

Wire for these coils was obtained from the original choke winding. It was allowed to bounce around in a bowl on the floor as the wire was used. Close measuring showed that removing two more layers would permit it to slide in place on the center leg of the core between the a-c coils. It was covered with a layer of Cellophane and household cement and used for the d-c winding.

When reassembling the core, the laminations should be stacked alternately as in a transformer, not as originally stacked with an air gap. The aim is to obtain a high initial inductance that will decrease rapidly as current flows through the d-c winding.

All components are mounted on a 5½" x 4" x 1½" chassis, with a 5⅝" x 4¾" panel. Components under the chassis are mounted wherever convenient. The whole unit is housed in a leatherette carrying case that originally contained a "personal portable" receiver.

Several oscillator circuits were tried before the present one, a shunt-fed Hartley, was installed. Most worked well when the inductance was high, but stopped oscillating when it decreased. The Hartley oscillator had a tendency to "gargle" under the same conditions until the condensers in the oscillating circuit were juggled to their present positions and capacities.

Care is necessary in connecting the a-c windings of the reactor. Correct polarity induces equal amounts of audio current, 180 degrees out of phase, into the center leg of the core. This prevents the d-c winding from absorbing oscillator power. The oscillator will work with incorrect polarization, but the correct connections are those that cause the *smallest* variation in oscillator output when the d-c winding is shorted out.

If an isolation transformer is used on the a-c input no special precautions need be taken when applying power to Oscar. As an a.c.-d.c. unit one side should be grounded and a single a-c lead brought out to the hot side of the 117-volt line.

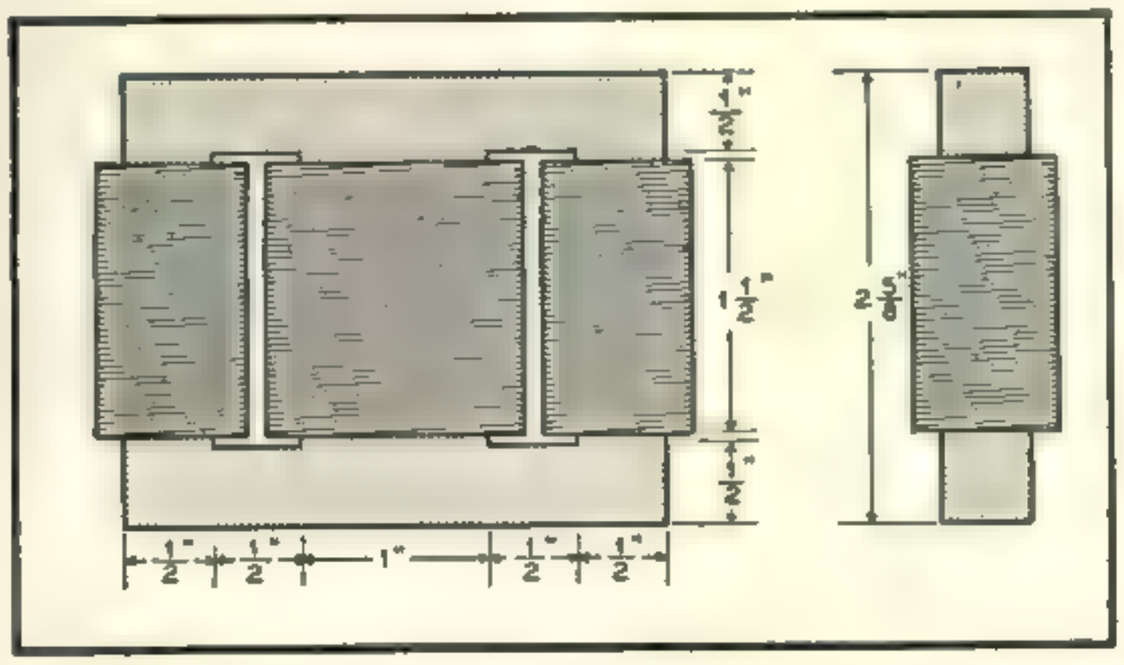
John Miller, W9PBS, tuning his transmitter with the aid of "Oscar" (on top of transmitter).

Oscar talked too loud when completed; so the 12-ohm resistor was connected in series with the speaker voice coil. Its value has some effect on the oscillator tone, so a variable volume control is not recommended.

Tuning With Oscar

Oscar is used exactly like a milliameter. The current to be measured is fed through the d-c winding, and its value judged by the change in frequency. At zero current the speaker emits a note of about 160 cycles, which increases almost linearly to 1,000 cycles at 400 ma. A current of 400 ma for two or three minutes does not cause excessive heating, but the winding will not carry this much current indefinitely.

A variation of one milliampere at any current between zero and 400 ma causes a noticeable



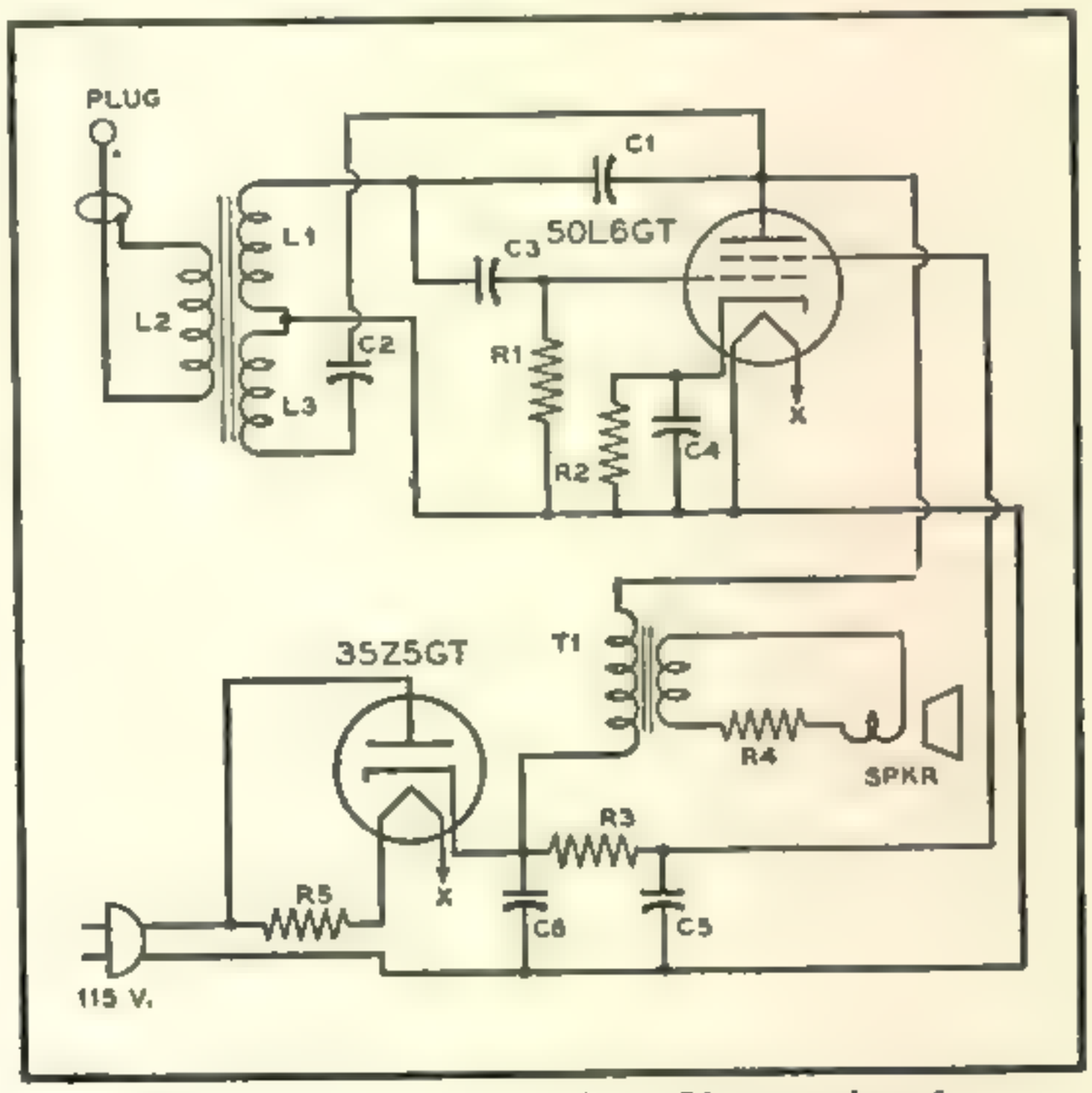


Fig. 1 (right). Circuit diagram of "Oscar," and Fig. 2 (left), construction and dimensions of the reactor.

C1—.07 μf, 400 v. (.02 μf and .05 in parallel).
C2—.01 μf, 400 v.
C3—.005 μf, 400 v.
C4—10 μf, 25 v.
C4, C6—20 μf, 150 v.
R1—100,000 ohms, ½ v.
R2—250 ohms, 20 w.
R3—2000 ohms, 5 w.
R4—12 ohms (see text).
R5—250 ohms, 20 w.
L1, L3—1200 turns No. 30 (2400 turns total).
L2—Part of original choke winding (see text and Fig. 2 for more details).
T1—7,000 ohms to voice coil.
Spkr—3-inch p.m.
P1—Phone plug for currents to be measured.

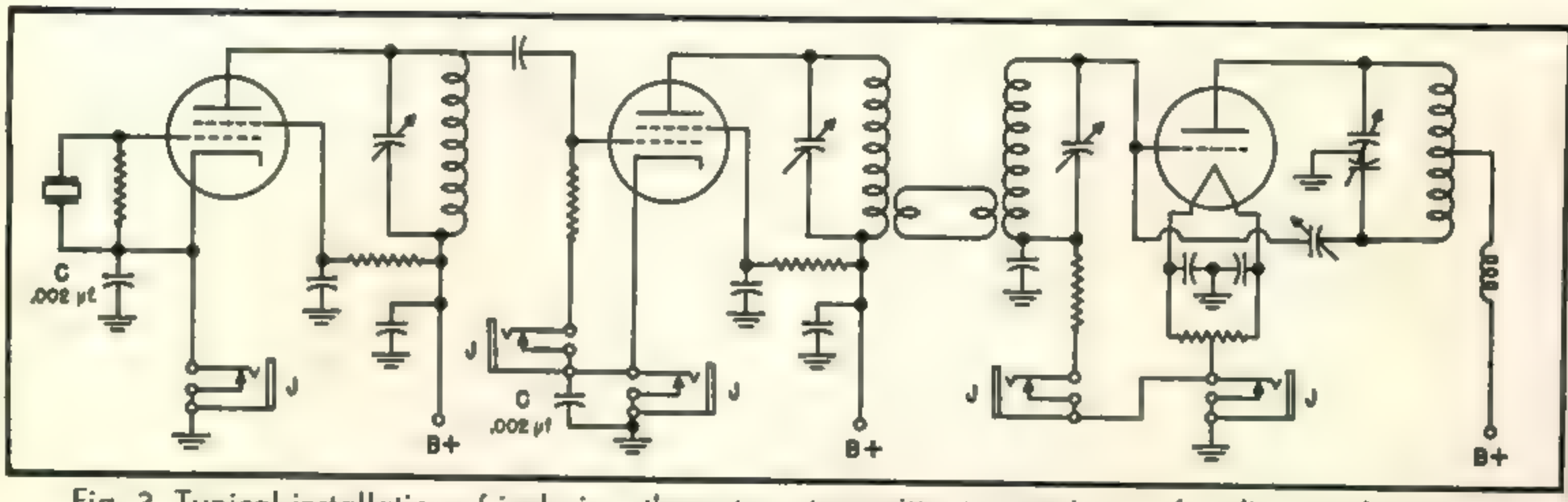


Fig. 3. Typical installation of jacks in a three-stage transmitter to permit use of audio tone for tuning.

change in pitch of the signal from the speaker. This means that a transmitter can be tuned as accurately using Oscar as with conventional meters. For "safety first," Oscar always should be connected in the low-voltage side of any circuit. *Figure 3* shows how jacks for it might be installed in a typical transmitter.

Oscar has one fault. Unless one has a sense of "absolute pitch" it is impossible to set currents accurately to a predetermined value, because the average person cannot remember small variations of pitch for more than a few seconds. However, this defect can be eliminated if a comparison tone generator is available. Then the pitch of Oscar's tone at various currents could be compared with a standard tone.

A piano gives 88 reference points, but is not as portable as it might be. A harmonica seems the simplest comparison tone generator. A third possibility is a simple audio oscillator, with separate speaker, running from the same power supply as Oscar. Its frequency control circuit would be a simple inductance with various capacities switcheu across it by means of a selector switch to vary its tone in controlled steps. Its use is obvious.

Suppose the transmitter to be tuned has the following design currents: oscillator plate, 42 ma., buffer (807) grid, two ma.; buffer plate, 80 ma.; final grid, 50 ma.; and final plate, 200 ma. Using a battery, meter, variable resistor, and the d-c winding of Oscar all in series, these currents are put through it in turn. Then the capacity across the inductance in the comparison oscillator at the corresponding switch positions is varied until the tone from the two oscillators is the same. Depending on the selector switch, any number of reference points may be set up.

Building Oscars for its sightless members is an excellent project for any amateur radio club. Incidently, Vic never divulged why he chose the name Oscar. Possibly he thought it would be fitting to give it a name similar to John's seeing-eye dog, Roger. The purpose of such dogs and Oscar are similar: to make the sightless more independent of the help of others.

Postscripts

Railway Emergency

The South Dakota 75-meter network came to the aid of the Milwaukee Railway on March 26th when wire communication between Roscoe and Aberdeen, S. D., was knocked out by high winds. The Roscoe station agent called WØOLB and asked him to communicate with the Aberdeen terminal for instructions regarding a Milwaukee train. For the next several hours traffic for the Milwaukee was routed via WØOLB, WØBLK, and WØUVL, with messages traveling over a 700-mile circuit until the 50-mile line between Roscoe and Aberdeen was repaired.

Mobile Operation

Among the changes in New York City traffic regulations which have been in effect since last December 31st is one which applies to motor vehicles equipped with radiotelephone facilities. The new regulation provides that the *operator* of such a vehicle shall *not* receive or transmit messages while the car is in motion, but must stop as near the curb as possible during this procedure. The rule does not apply to passengers.

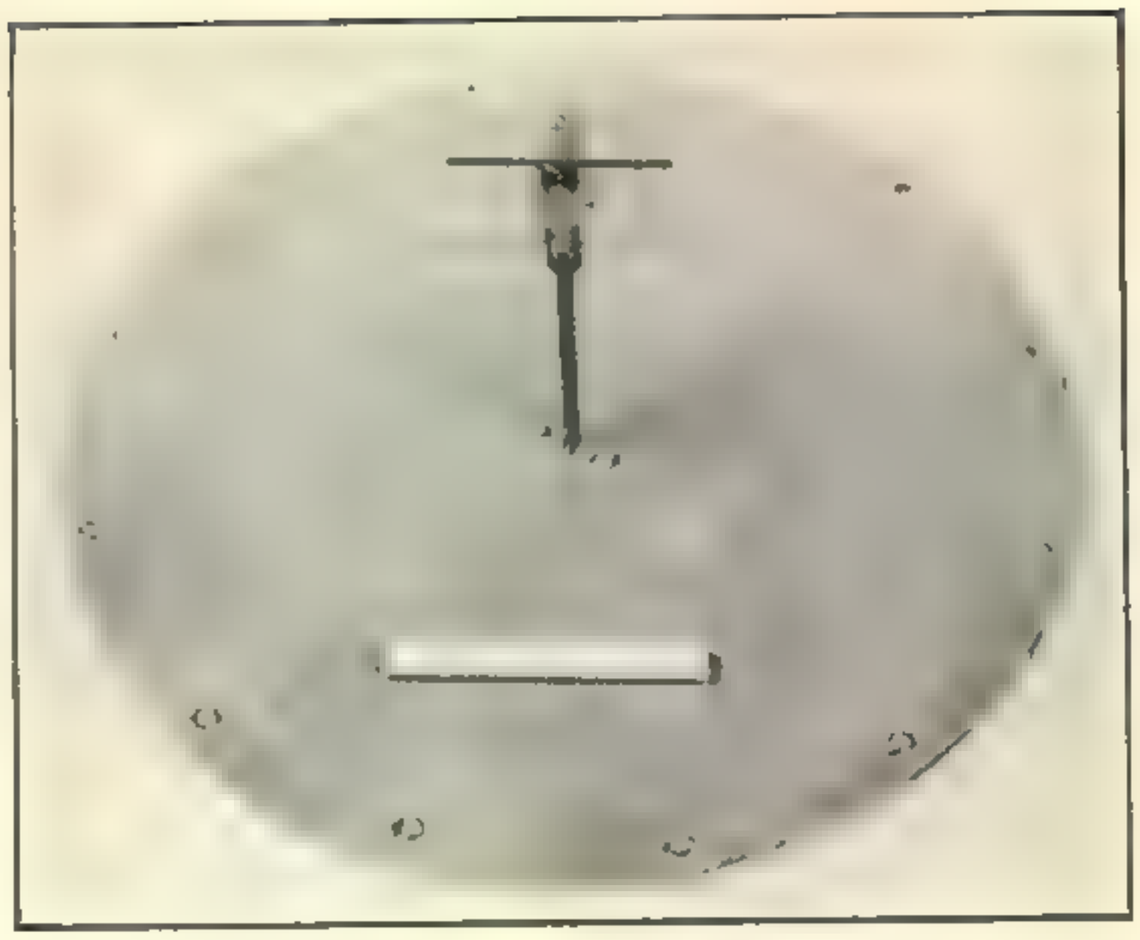
Delaware Ham Directory

The Delaware Amateur Radio Club has announced that it has a directory containing the names, calls, QTH, telephone numbers, and band activity of Delaware hams. The directory, which would be especially handy for those needing this state for WAS, is available to anyone for 50c.

Emergency Radio Patrol

A number of hams living in and near Santa Cruz, Calif., who have mobile equipment in their automobiles, have been sworn in as special sheriff's deputies, comprising the only radio posse of its kind in northern California. The purpose of the patrol is community betterment and protection by furnishing communications for the Red Cross and other relief agencies, fire units, and law enforcement agencies in case of emergency or disaster of any nature. The group can also take to the field to hunt for lost persons by cooperating with the mounted posse and using walkie-talkie units for which the mobile units can pick up and relay messages. Regular meetings and drills are held, with training in first aid, self defense, fire fighting, local laws, manitenance of equipment, etc. The group, which expects to eventually have 25 active members, now includes W6KEO, W6QLU, W2ZGR, W6NBR, W6CCW, and several unlicensed members having receivers only for one-way communication.

Fig. 1. Scale model of the four-element parasitic beam array used in recording vertical and horizontal lobe patterns as compared to a cigarette.



◆ ◆

DAVID C. CLECKNER, W8YBF*

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Some of the reasons certain beams outperform others are graphically illustrated.

Parasitic Beam Patterns

A CORRECTLY TUNED and adjusted parasitic beam antenna has a distinct advantage in high-frequency communication. In comparison to a simple half-wave dipole it has a worthwhile power gain and it can be made unidirectional and rotatable in a relatively small space. The lengths of the parasitic elements or tuning conditions necessary if variable capacitances are used at the center of the elements are dependent on numerous parameters, most important of which are the number, the spacing, and the diameter of the elements in the array. The pattern of the parasitic beam is not dependent upon the nput impedance or radiation resistance of the array; however, the over-all efficiency is dependent upon the input impedance and the losses in the feeder system. The efficiency of the parasitic beam will not be discussed since this is a problem of electrical and mechanical construction. In contrast, once the beam is assembled the criterion by which many amateurs tune their arrays is the horizontal pattern. Generally the use of the front-to-back ratio and/or the front-to-side ratio is an excellent yardstick. However, it would be helpful to know the entire hemispherical vertical pattern particularly at low angles above the horizon. Knowing this, it can be used to adjust the height of the array and to orient the array for optimum operating conditions.

With the exception of purely theoretical patterns it had been until recently nearly impossible to obtain accurate data on vertical radiation patterns. Wartime research at The Antenna Laboratory of The Ohio State University Research Foundation showed that actual conditions could be reproduced through the use of scale models.

Microwave Scale Models

The vertical patterns as well as horizontal patterns are obtained by constructing scale models and operating them at centimeter wavelengths. The methods have been described by Sinclair, Jordan, and Vaughn.[1] In these tests the antennas were one-

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1 *Proceedings of the I. R. E.*, Vol. 35, No. 12 (December, 1947), pp. 1441-1462.

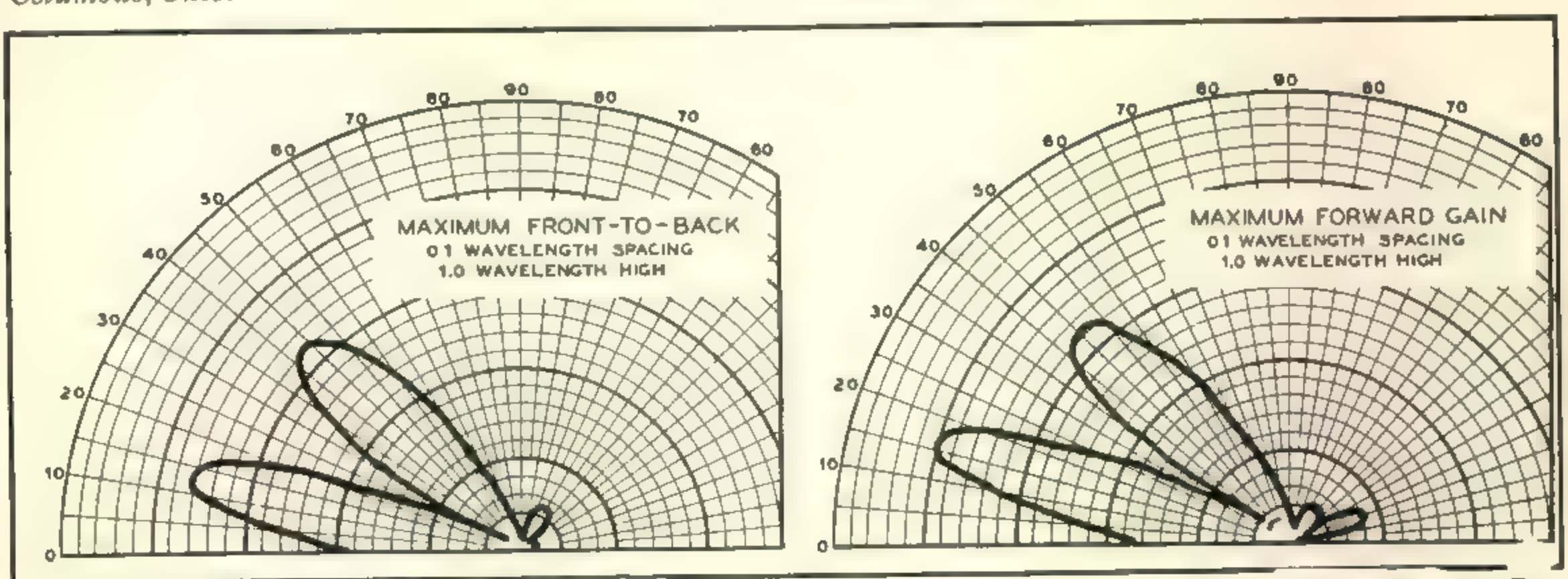


Fig. 2A (left). Vertical lobe structure when tuning a three-element array for maximum front-to-back ratio. Fig. 2B (right). Tuning the same antenna for maximum forward gain.

hundredth scale models of 10-meter parasitic beams. The model is mounted above a circular disc that is fastened in the center of the square ground plane (*Fig. 1*). The radiating element is a folded dipole which feeds a power-detecting bolometer receiver. Thirty feet away from the ground plane is a fixed cone or beam of radiation coming from a 10-cm klystron oscillator and an electro-magnetic horn type radiator. The parasitic beam receives the signal; it is then detected and passed on to an electronic square rooter which automatically converts the output of the bolometer to a usable field strength basis. The ground plane and the attached beam antenna are rotatable and the ground plane can be tilted so that the complete hemispherical pattern can be recorded using a Selsyn link between the ground plane and a recording polar coordinate chart.

The ground plane is approximately eleven wavelengths in diameter. While this is not large enough to completely eliminate diffraction over the edge of the ground plane, it is large enough to measure accurately the lobe structure of the various antennas. These patterns are plotted on a relative voltage basis and it should be pointed out that they preclude no disturbing vertical radiation from the feed system, house wiring, metal roofs, downspouting, other antennas, etc.

Various models were constructed by supporting thin wire reflectors and directors in polystyrene. The parasitic elements were then cut to length by snipping off minute pieces of wire from each end of the element.

Three-Element Beam Pattern

The first series of patterns were recorded after the three-element parasitic beam had been adjusted for maximum front-to-back ratio. The spacing between elements is 0.1 wavelength and the height above the ground plane is one wavelength. *Figure 2A* shows the vertical lobe structure. This pattern was recorded by moving the ground plane and attached beam antenna so that the transmitting horn essentially moved from the front of the array up over the top of it and down to the back of the array. *Figure 3* shows six radiation patterns taken at different vertical angles above the horizon. These were recorded by tilting the ground plane along with the attached antenna to the desired angle above the horizon and swinging it through a 360° arc.

The number of polar patterns shown in *Fig. 3* illustrate the relative field strength radiated at the indicated angles, the width of the forward lobe, and the structure of the radiation pattern to the back and sides of the array. At all of the measured angles above the horizon there is practically no power radiated directly behind the beam. However, two small lobes are noted on either side behind the array. The power radiated in these lobes is very small resulting in a front-to-back ratio of approx-

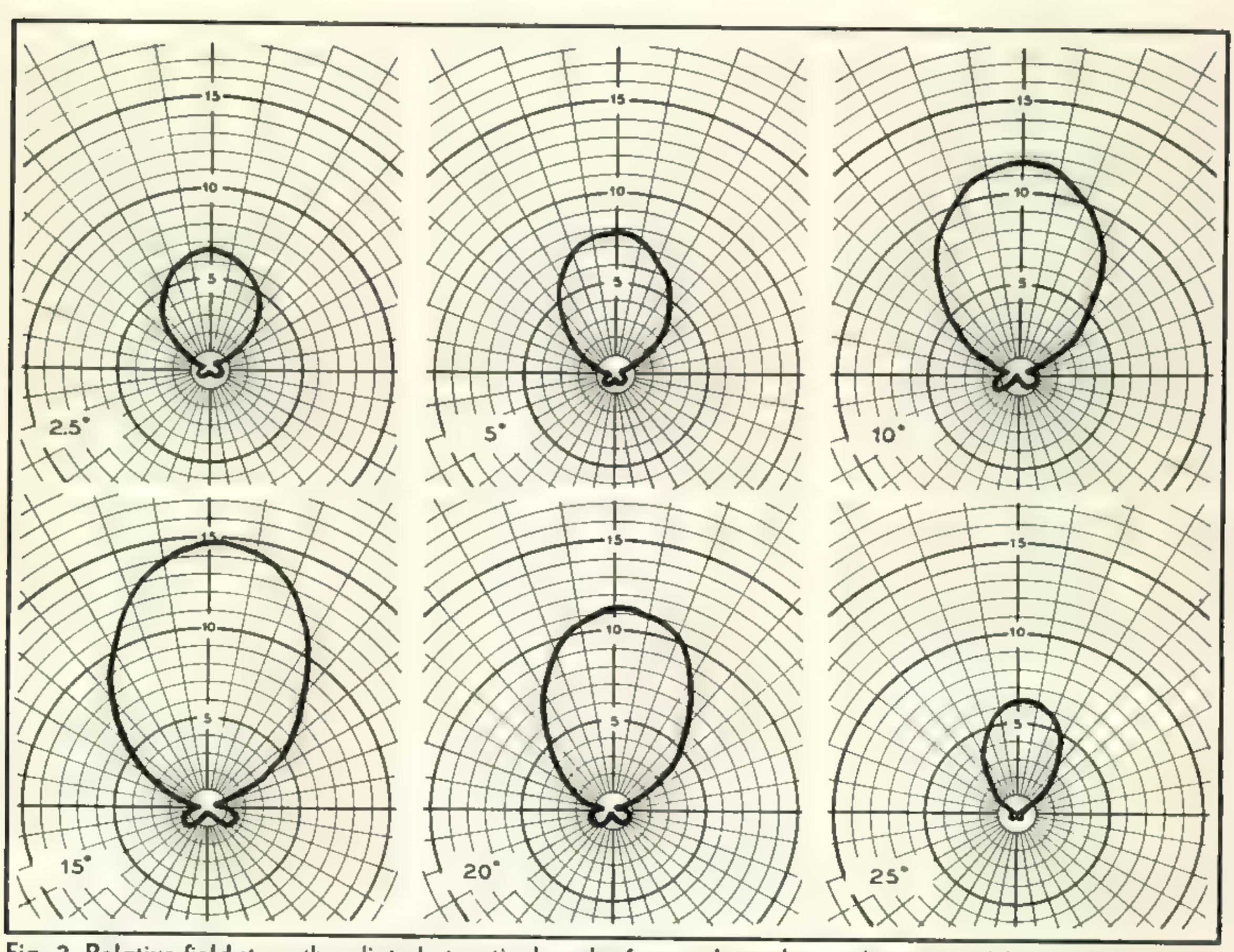


Fig. 3. Relative field strength radiated at vertical angles from a three-element beam tuned for maximum front-to-back ratio.

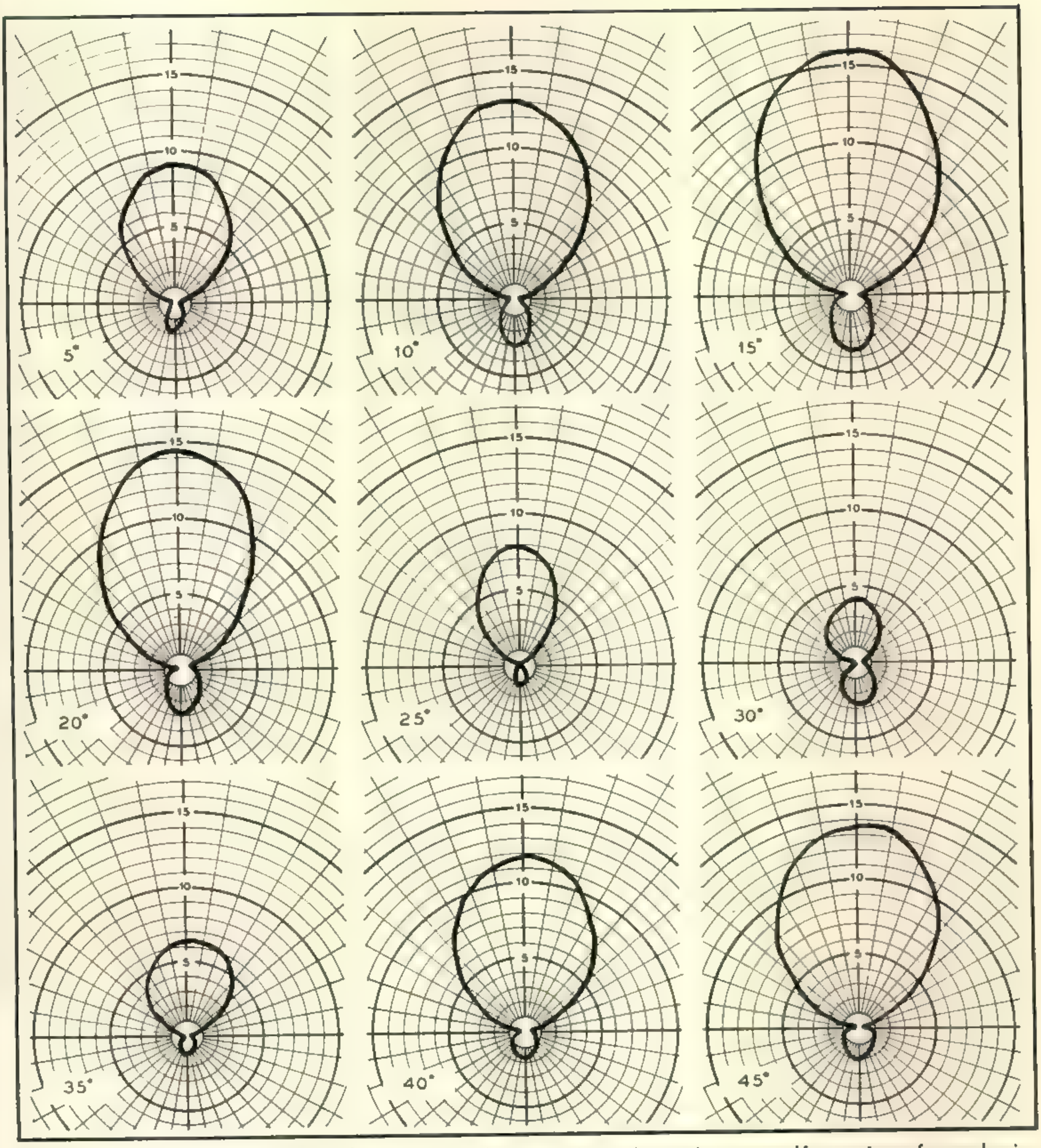


Fig. 4. Relative field strength radiated at vertical angles from a three-element beam tuned for maximum forward gain.

imately 30 db. Referring to *Fig. 2A* we can see that at the greater vertical angles the two small side lobes move more to the rear of the beam and slowly combine into one single rear lobe at about 60°.

The set of patterns in *Fig. 4* show the same three-element beam adjusted for maximum forward gain. *Figure 2B* shows the vertical lobe structure. These patterns show a large lobe to the rear of the array at approximately 20° above the horizon with a slightly smaller lobe occurring at about 50°. Very deep minima were present off the ends of the elements. Note that the rear lobe is now undivided and at an angle of about 30° the parasitic array is radiating a near figure 8 pattern.

Maximum Ratio vs. Maximum Gain

Further analyzing these patterns tells us a little more of what to expect from these two tuning conditions. With a maximum front-to-back ratio it was noted that the lowest lobe was about 2° lower than normally predicted by theory for this height above ground.[2] While this may be in part due to an observational error, it is thought that the lowering of the angle is a positive effect, since it is also collaborated in amateur practice. Actually the operational difference in the amount of power radiated at an intermediate angle (say 10°) is negligible, since

[2] Ferrell "Notes on the Angle of Radiation," *CQ*, April, 1947.

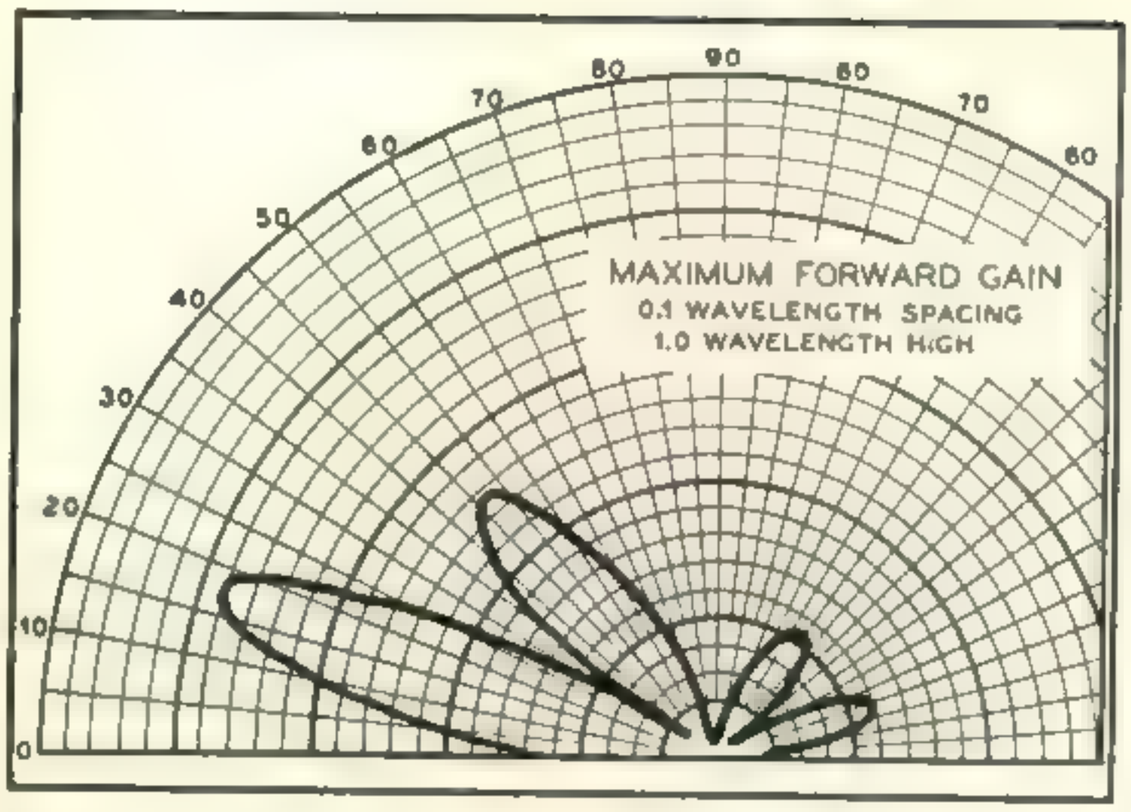


Fig. 5. Vertical lobe structure of a four-element beam tuned for maximum gain.

the beam with the maximum forward gain is concentrating more power in this particular lobe. A similar effect is noted in the second highest lobe at about 43° or 46°. In both instances the null is slightly above 30°. The width of the forward lobes at the half power points under these conditions is approximately the same. However, with the maximum front-to-back ratio about 40% of the radiated power is above an angle of 30°—an angle seldom encountered in 10-meter DX work.[2] With maximum forward gain there is about 10% more power concentrated in the lower lobe.

Thus, laboratory measurements tend to show that the choice is a matter of personal preference dictated by particular operating conditions. An example of this would be New England stations who would select maximum front-to-back ratios to reduce the QRM from mid-western and Pacific Coast stations while working European DX.

Four-Element Parasitic Patterns

The addition of a second director to the beam array results in an increase in the forward power gain. *Figure 5* shows the vertical lobe structure of the four-element beam. If *Fig. 5* is compared to *Fig. 2A* and *Fig. 2B* it will be seen that the volume of the second vertical lobe is appreciably smaller. This indicates that the gain of the four-element array over the three-element array is largely due to the reduction of the power radiated in this high angle lobe. The horizontal extent of the large lower lobe is shown for six vertical angles above the horizon in *Fig. 6*. The dashed line pattern in the upper right-hand corner (15°) of this figure illustrates the difference in the width of the lobe of the three-element and the four-element beams. The pattern is made by assuming equal forward gain and serves only to show slenderizing in the case of the four-element beam.

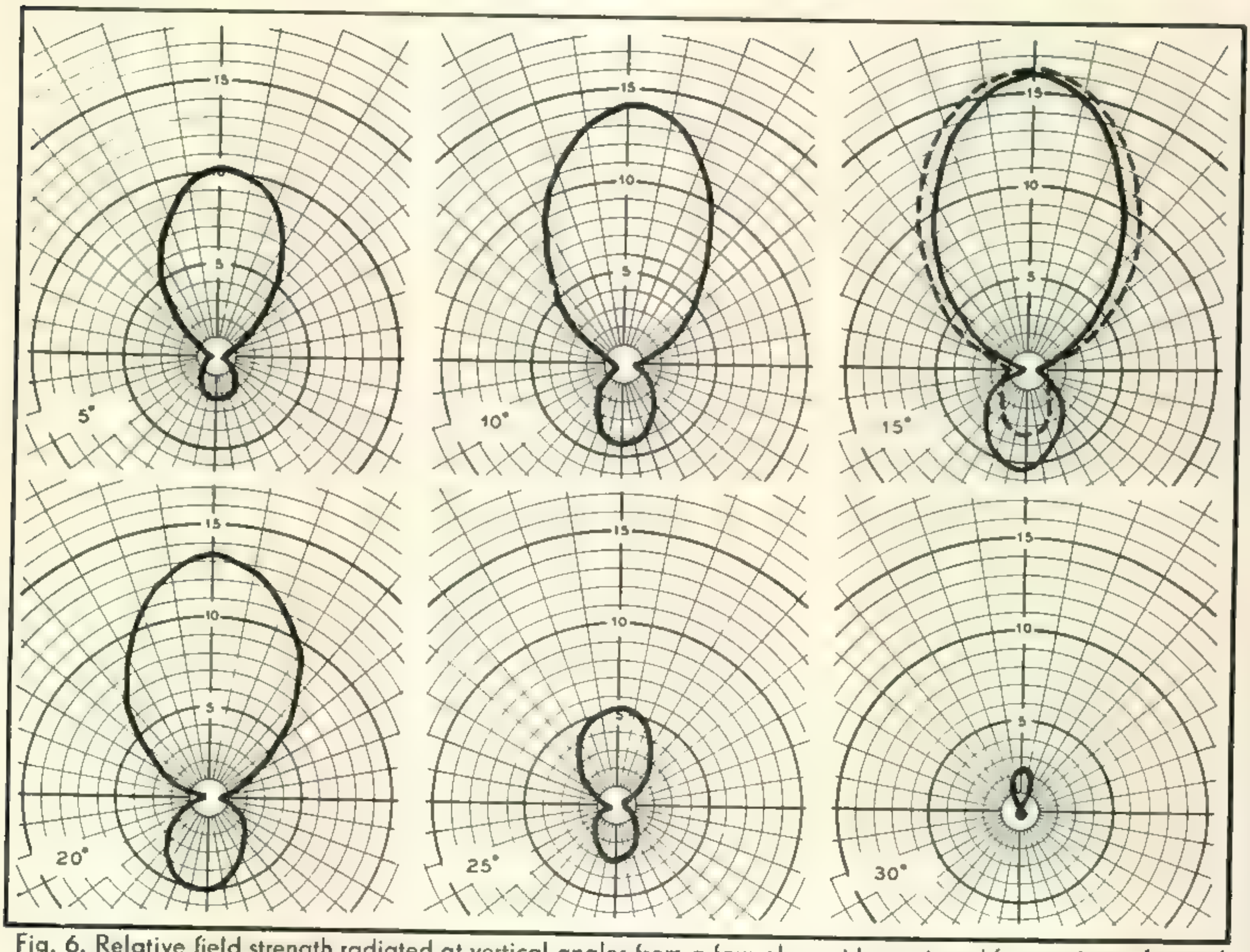


Fig. 6. Relative field strength radiated at vertical angles from a four-element beam tuned for maximum forward gain. The dashed line pattern in the upper right-hand corner shows the comparative width of the three-element and four-element beams if both radiated the same power at 15°.

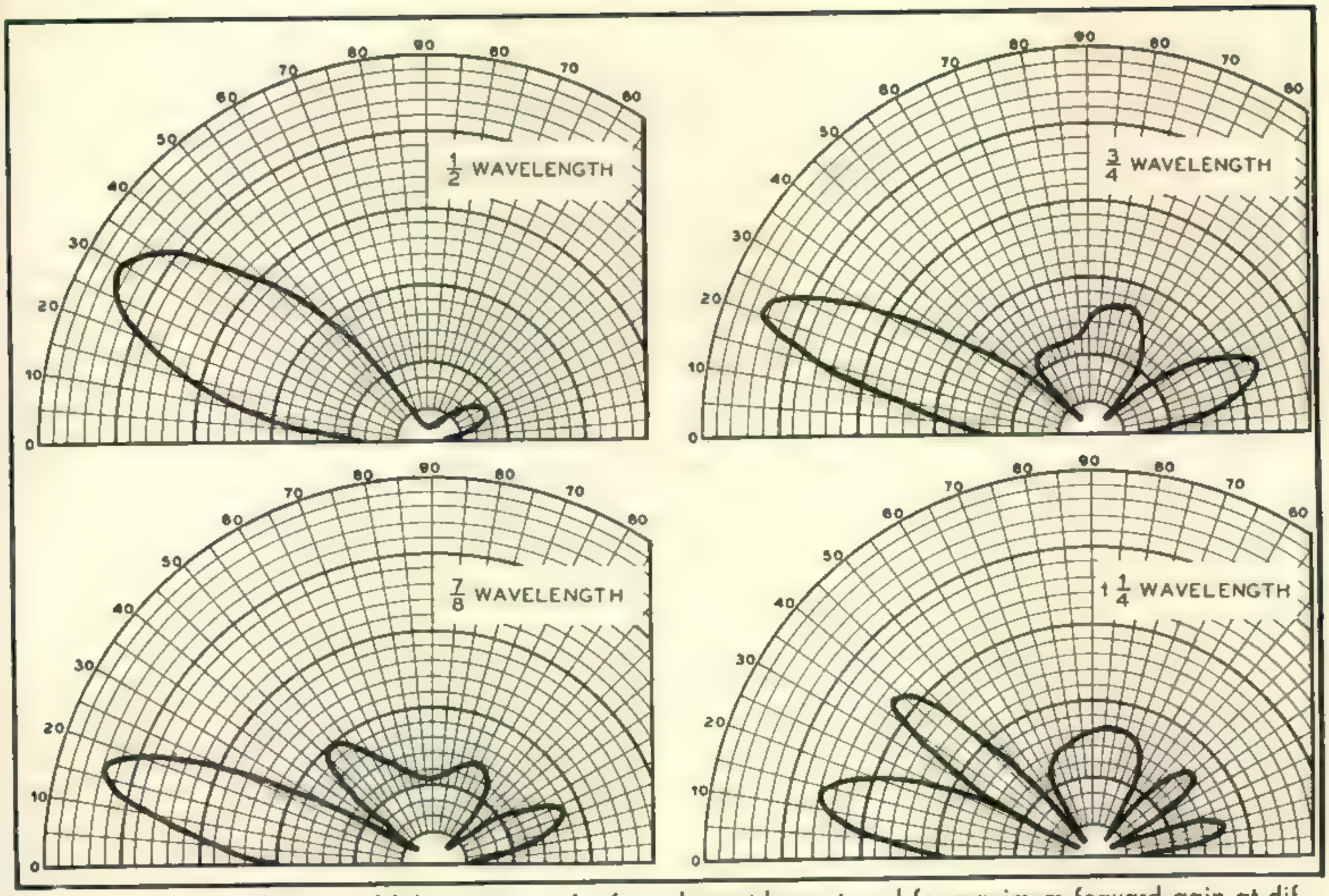


Fig. 7. Variation in the vertical lobe structure of a four-element beam tuned for maximum forward gain at different heights above ground.

Lobe Variations with Height

Antenna radiation theory does not accurately predict the formation of the side and rear lobes from parasitic beam arrays. To a very large extent these are due to tuning adjustments as shown in *Fig. 2A* and *Fig. 2B*. It was interesting to take the same four-element beam and observe the variations in the vertical pattern with change in height above ground. *Figure 7* shows the vertical patterns at heights of ½ wavelength, ¾ wavelength, ⅞ wavelength, and 1¼ wavelengths. The patterns are not comparable and only show the lobe angles and relative field strength radiated.

At ½ wavelength in height the pattern consists of a single rather broad forward lobe and a small lobe to the rear of the array. The maximum power is radiated at an angle of about 29°. Increasing the height ¼ wavelength lowers this angle to 21°, while at the same time greatly extending the lobe to the rear of the beam and creating considerable radiation at the high vertical angles. A change of ⅛ wavelength (to ⅞ wavelength in height) again lowered the angle of maximum radiation and clearly established a second lobe in the forward portion of the pattern at about 50°. With the beam array 1¼ wavelengths in height the lowest maximum radiation is about 14° above the horizon. The second lobe is at 38° and a third lobe appears to be forming at the high vertical angles overhead. It should be noted that even though the amplitude of the higher lobe may be nearly equal to the amplitude of the lower lobe (at one wavelength height for example) that the total power in the upper lobe is not equal to that in the lower lobe because the surface areas of the two lobes are not equal.

Conclusions

These graphs have depicted representative and typical radiation patterns generated by three and four-element parasitic beam arrays. In general, they have shown the following points:

1. It is possible to obtain a front-to-back ratio of over 30 db. On the 10 and 20-meter bands this may result in a waste of power at the high and unusable angles, although apparently the lowest angle of maximum radiation is somewhat reduced in the process.

2. Tuning for maximum forward gain will allow a front-to-back ratio of about 20 db. The pattern obtained in this case agrees well with that predicted by theory. Some decrease in the high angle radiation is noted at a height of one wavelength above ground.

3. The four-element array radiated more power in the forward direction by making a large reduction in high angle radiation (at some heights above ground). The front-to-back ratio is generally not as good as that obtained with the three-element beam array, although the forward pattern is somewhat sharper.

4. Much depends upon the height of the array above the ground. It must be a compromise unless the array can be raised and lowered. The intermediate heights between one and two wavelengths cause too much "cloud warming" through excessive high angle radiation. Probably the best height is between ¾ and 1 wavelength or over 2½ wavelengths above ground.

Inside the SHACK AND WORKSHOP

Conducted by A. DAVID MIDDELTON, W1CA*

Coax Antenna Connector for Command Transmitters

Owners of the BC-459 and similar series of transmitters may desire to use them both as v-f-o units and as complete transmitters for portable operation.

Without any change in the antenna tuning system, both coax and standard binding post connections may be made available if a JS-1 jack shield is placed around the antenna post, with a coax chassis-cable connector mounted in the side of the jack shield.

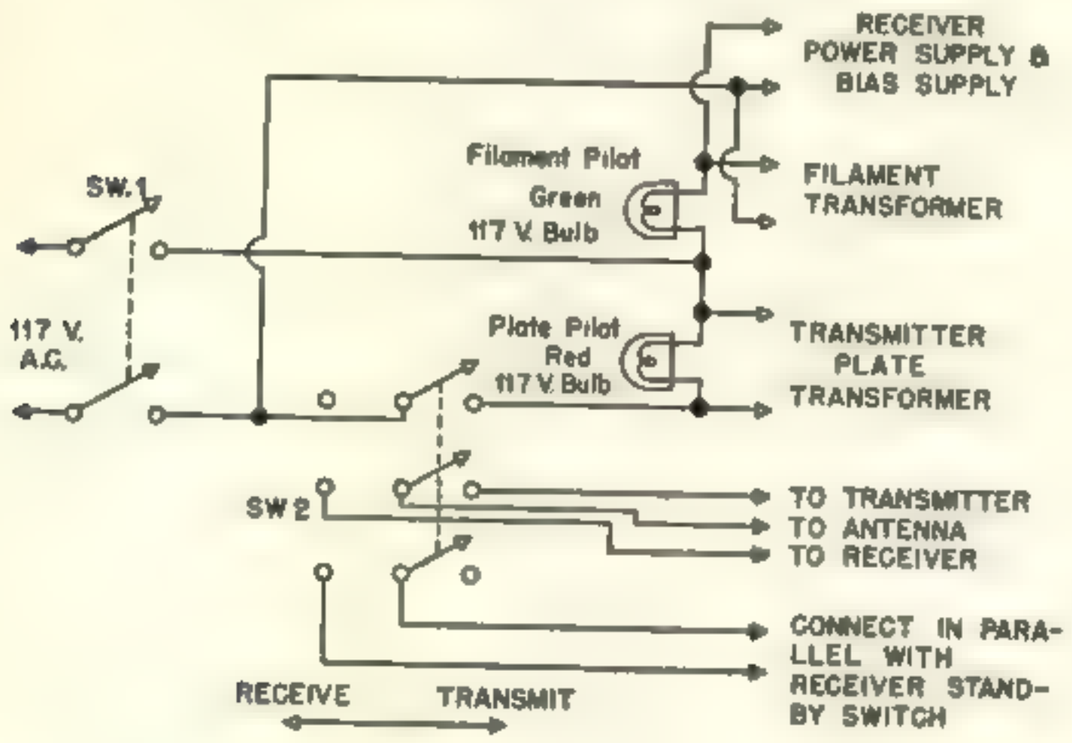
Remove the binding post, put the jack shield in place and replace the binding post. Connect a short length of wire from the center connector of the coax fitting to the normal binding post. Ground the chassis connector carefully to one of the jack shield screws. This provides a shielded coax connection for v.f.o. use and a normal antenna post for other operation of the transmitter.

F. C. Breeden, W2SIJ

Transmitter-Receiver Control Switch

At W9CPU complete antenna switching, receiver silencing and transmitter plate supply control is effected on one 3-pole double-throw switch, and no relays. If tuned feeders were used (we use a grounded Marconi antenna so have only one lead) we would use a 4-pole switch. An additional DPST toggle (SW_1) controls all the primary power to the transmitter supplies.

The STAND-BY switch on the receiver is left open, and the 3-pole switch controls the entire station



operation. If it is desired to have the receiver on, as for use during v-f-o calibration, connect a SPST spring-return-to-open (telephone type) key switch across the bottom contacts on the 3-pole switch, SW_2.

S. W. Skipworth, W9CPU

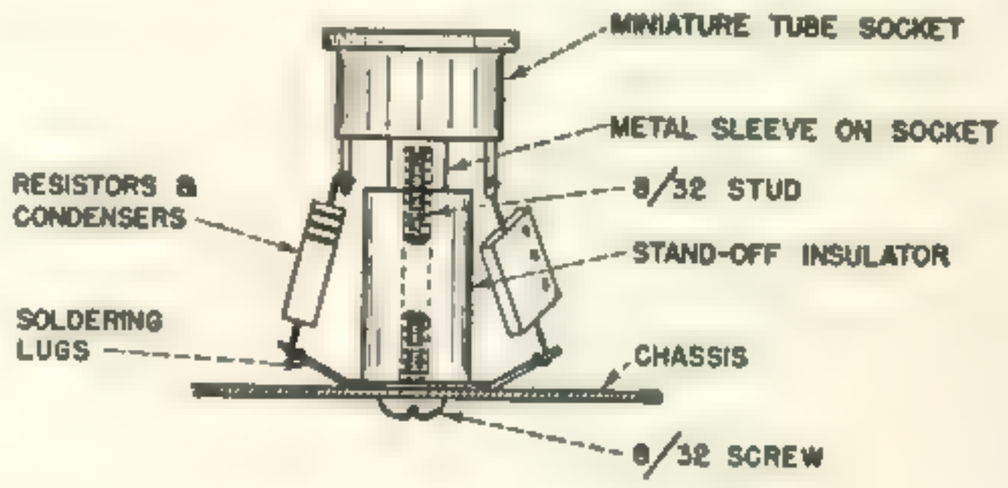
Send-Receive Relay Operated by Receiver B Supply

We recently came across an excellent ceramic-insulated relay with just the right combination of circuits, but it was a 12-volt job. We found that the relay would operate on a current flow of 80 ma. So it was placed in *series* with the B— lead to the receiver, and since the receiver draws about 90 ma, everything worked fine. The 12-volt drop caused by the relay was not enough to effect receiver operation. The relay is arranged so that when receiving, the antenna is on the receiver and when the receiver stand-by switch is open (the B— is off) the relay is not energized, and the antenna is connected to the transmitter.

Meyer Birnboim, VE4LT

Mounting Miniature-Tube Sockets

The use of miniature tubes often calls for the connection of resistors and condensers around the socket in such a manner as to make assembly difficult. By mounting the socket above the chassis, these necessary components can be placed efficiently as well as conveniently.



Run solder into the protruding metal sleeve of the socket and shake out the excess solder while it is still hot. This will leave a thin coating of solder in the sleeve. An 8/32 screw will thread itself into the sleeve. Mount the socket on top of a suitable standoff insulator by means of a headless screw or stud, as shown in the drawing. Mount the standoff on the chassis, and place grounding lugs under the insulator. These provide a one-spot ground for the components. Place these around the insulator, suspended from the tube prongs.

The entire stage can be shielded, if desired, as all the stage components are grouped around the insulator in a small space.

W. R. Pearce, ex-W1GKH

Recording for Code Practice

Those who desire to record code practice material and find that most stations send too fast, may find the following suggestion helpful.

Stations transmitting (of the type desired for code practice use at some later time) often transmit at too high a speed, so record them at 78 r.p.m., but play them back at 35 r.p.m. Thus 40 w.p.m. is reduced to 17 w.p.m. and 25 w.p.m. to 10 w.p.m. Since the pitch of the note is reduced in the same ratio as the speed, the receiver's b.f.o. should be set to give a note approximately double the usual pitch while making the recording.

Just as a note of warning, the regulations concerning the secrecy of transmitted correspondence should be carefully observed when intercepting any transmissions.

Angus G. Pearson, W5MPE

****Address all contributions to S & W Department c/o CQ, 342 Madison Ave., N. Y. 17, New York.**

The TV Receiver: Its Operation and Common Forms of Interference

WILLIAM BROWN, W2IBK *

TO FULLY COPE with the problems of TVI we should be prepared not only with an adequate understanding of the operation of the television receiver, but also with a full knowledge of all of the factors that may cause improper operation of the set. Being able to discuss the alleged interference intelligently goes a long way toward soothing the ire of the complainant and quickly directs the discussion to the productive lines suggested in the companion articles.

It is an object of this article, which is primarily concerned with television receivers, to familiarize the reader with the general circuit arrangement of the TV set. Since obviously the complainant's receiver is not functioning properly, and we amateurs are the most accessible source of difficulty, it is necessary that we be in a position to at least roughly localize the trouble whether we are the cause of it or not. For example, if the complaint is that the set does not light up, we naturally suggest that perhaps a fuse has blown, or that the set is not plugged in. If the complaint is that the picture is barely discernible, and the sound is extremely weak, we quickly suggest that possibly the antenna has blown down, or the feed line has become disconnected from the set. Now the above diagnoses require no knowledge on our part of the workings of the TV receiver. However, as we shall see, there are many many other symptoms, mysterious to the uninitiated, that can be quickly diagnosed provided we have a clear knowledge of how the set works.

Unfortunately, not all of the troubles can be guided quickly to a particular fault by a mere working knowledge of the receiver. However, it is generally possible to diagnose the majority of the possible TV disturbances by an inspection of the received picture, and in this article emphasis will be placed upon the interpretation of a poor picture as being caused by a certain fault in the set.

The Typical TV Receiver

Let's look at a typical television receiver, shown in simplified block diagram form in *Fig. 1*. It consists essentially of a mixer and local oscillator, often preceded by an r-f amplifier as in conventional superheterodynes, followed by separate i-f amplifiers, one for sound and one for picture, synchronizing and deflection circuits, high and low-voltage power supplies, the kinescope and speaker.

A composite television signal radiated by the transmitter antenna consists of separate picture and sound carriers spaced 4.5 mc apart. The picture carrier is amplitude modulated by picture information with components extending as sidebands from 30 cps to 4 mc above the picture carrier. The sound carrier is frequency modulated by audio information with a maximum of 25-kc deviation. This composite sound and picture signal is intercepted by the receiver antenna and amplified by the r-f amplifier, if one is used, at signal frequency, the station frequency varying from 54-60 mc for channel 2, to 210–216 mc for channel 13. The local oscillator, operating at 12 to 38 mc higher than the incoming signal, depending on the intermediate frequency used, beats with the sound and picture carriers to produce two lower frequencies, the picture and sound i.f.s, still separated by 4.5 mc. These are separately amplified (except in the inter-carrier system), demodulated, and in the case of the audio, translated into sound. The detected picture information containing components from 30 cps-4.0 mc is further amplified by the video amplifier, the synchronizing signals are removed and applied to the deflection circuits. Picture and synchronizing information is applied to the picture tube or kinescope and translated into visible light and shadow.

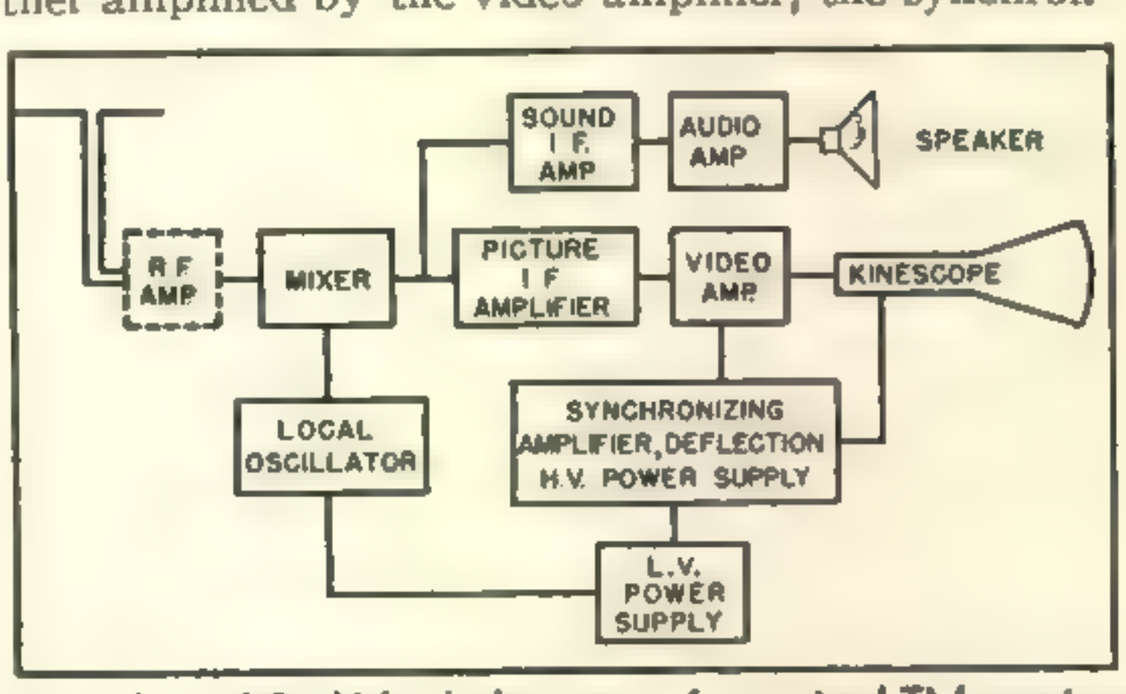


Fig. 1 Simplified block diagram of a typical TV receiver.

Synchronizing and Deflecting Circuits

For the benefit of those readers who may not be familiar with the synchronizing and deflecting circuits, a brief description is given of the operation of these vital portions of the TV receiver. The picture viewed on the kinescope screen is the result of the conversion of a moving beam of electrons into visible light, due to their action when they impinge on the fluorescent screen.

This movement or "scanning" must be in exact synchronism with a similar action at the television

* *1155 Neilson, Far Rockaway, N. Y.*

Interference patterns courtesy Allan B. DuMont Laboratories, Inc.; Belmont Radio Corp., and Admiral Corp.

camera. The TV transmitter sends out a series of impulses, called synchronizing signals, at the start of each line. (There are 212½ lines transmitted each sixtieth of a second, called a field, and there are 525 lines each thirtieth of a second, or frame.) Each field of 212½ lines must fall halfway between the corresponding lines of the previous field. This process is called interlaced scanning.

The scanning circuits at the receiver are controlled by the corresponding synchronizing impulses sent out along with the picture information transmitted. The frequency of operation of the horizontal deflection circuits which move the beam from left to right on the screen is determined by multiplying the total number of lines each frame by the total number of frames per second, that is 525 x 30 = 15,750 cps. This is known as line, or horizontal, frequency. The beam must also be moved from top to bottom of the picture and this is done at a 60 cps rate called field frequency.

These impulses synchronize the operation of the vertical and horizontal impulse generators in the receiver, so that each line in the received picture starts at the same instant as the corresponding line in the transmitted picture (less the delay in transmission). The impulses are applied to the vertical and horizontal output stages, amplified and applied to either a magnetic deflection yoke or electrostatic deflection plates, depending on the type of TV receiver construction. This is shown in block diagram form in *Fig. 2*. An additional refinement shown below which is generally employed in the latest receivers, is automatic frequency control of synchronization, or a.f.c. In this process the phase of the incoming sync signal is compared with the locally generated deflecting wave and any variation between the two is translated into a d-c correcting voltage which is applied to a frequency controlling element associated with the horizontal oscillator. This tends to give a clearer and steadier picture, if properly designed, and is less susceptible to interference.

It is obvious from the above that it does not take much in the way of a disturbance to upset the delicate timing mechanism of the TV receiver causing the picture to lose either vertical or horizontal synchronization. These effects are shown in *Figs. 3* through *6*. If we apply the same method of analysis described earlier, we can readily establish the offending interference as emanating from our own rigs or elsewhere.

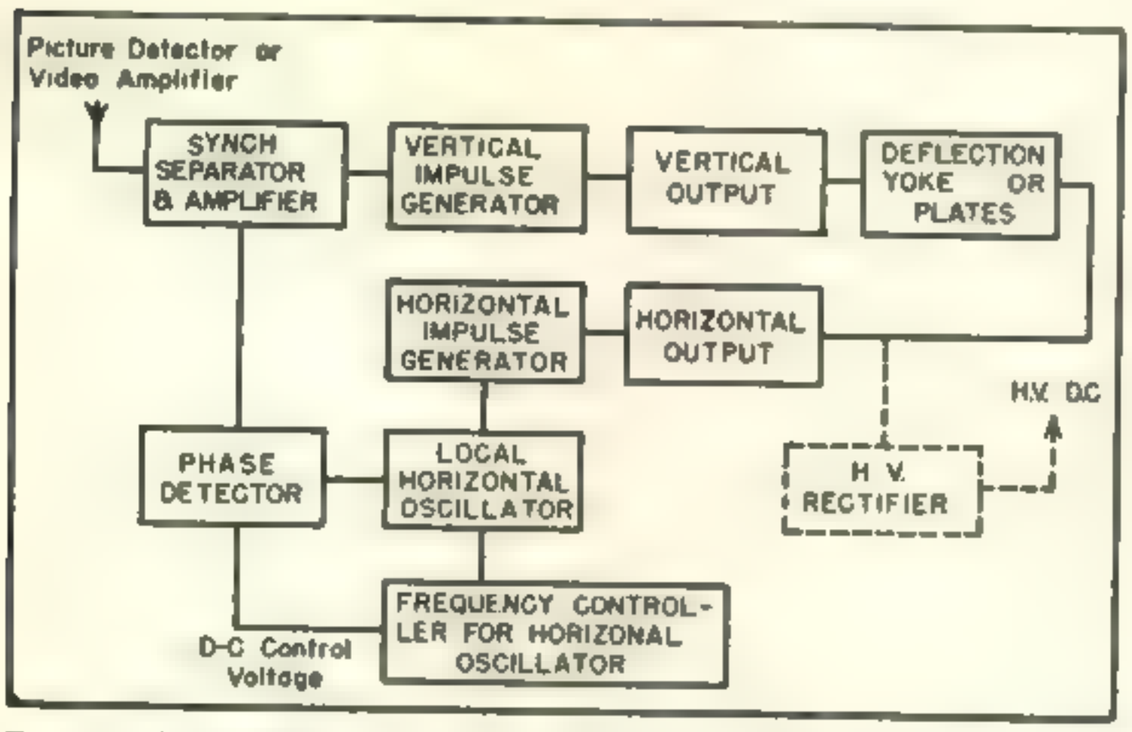


Fig. 2. Simplified block diagram of the synchronizing and deflecting circuits of a television receiver.

Another kind of interference in a TV receiver is a change in brightness and/or size of the picture, in phase with keying or modulation. As shown in *Fig. 2*, most receivers obtain their high-voltage supply for the kinescope by rectifying the horizontal pulses used to initiate the picture sweep. A change in line voltage will cause this voltage to vary, which will in turn cause the picture brightness and size also to change. We can trace this source of interference by noting whether it occurs while we key or modulate, without regard for the band on which we are transmitting. It is usually caused by poor line voltage regulation, and a larger line to the rig, having less voltage drop, is one answer to this problem.

Another feature incorporated in some receivers, and a potential source of trouble, if poorly designed, is automatic gain control or a.g.c., applied to the picture i-f amplifier and r-f amplifier. This is particularly susceptible to impulse noise interference, such as automobile ignition or even a change in line voltage such as is caused by a refrigerator or oil burner starting. It shows up as a complete disappearance of the picture (the screen goes black) momentarily. This is primarily a receiver design problem, but we should be able to recognize it and diagnose its source.

Any signal within the r-f, i-f, or video passbands of the receiver, or images thereof, if strong enough, can cause a disturbance on the screen. This includes automobile and oil burner ignition, diathermy, aircraft transmitters, FM broadcast transmitters, r-f heating, ultraviolet lamps, radiation from other television receivers, radiation from FM sets, X-ray machines and harmonics of amateur transmitters. Our transmitter is only one of many potential sources of interference. Very often a maladjusted TV receiver, out of synchronization, is diagnosed as amateur interference, when nothing could be further from the truth.

Diagnosing The TVI

Our first problem then, is to correctly diagnose the cause of the strange patterns observed on the kinescope. There are two main effects caused by interfering signals. They can affect receiver synchronization, which usually means a completely unsatisfactory picture, or they can appear as a bar or crosshatch pattern superimposed on the picture. *Figures 3* and *4* show a typical picture affected by loss of vertical synchronization. *Figures 5* and *6* show the same for loss of horizontal synchronization. To determine whether we are causing this trouble, have a fellow amateur operate the rig and observe if the effect occurs in synchronism with the keying or modulation. If not, we're not guilty on this count.

The next most common complaint appears as shown in *Figs. 7* and *8*. We recognize this type immediately for what it is—ignition interference. This usually can be correlated with the oil burner or a passing automobile. *Figure 9* shows the effects of diathermy interference. This is more difficult to correlate with its source, which can be quite a distance away, for unshielded units. However, a little detective work can usually track this down to its source in doctors' offices or hospitals nearby.

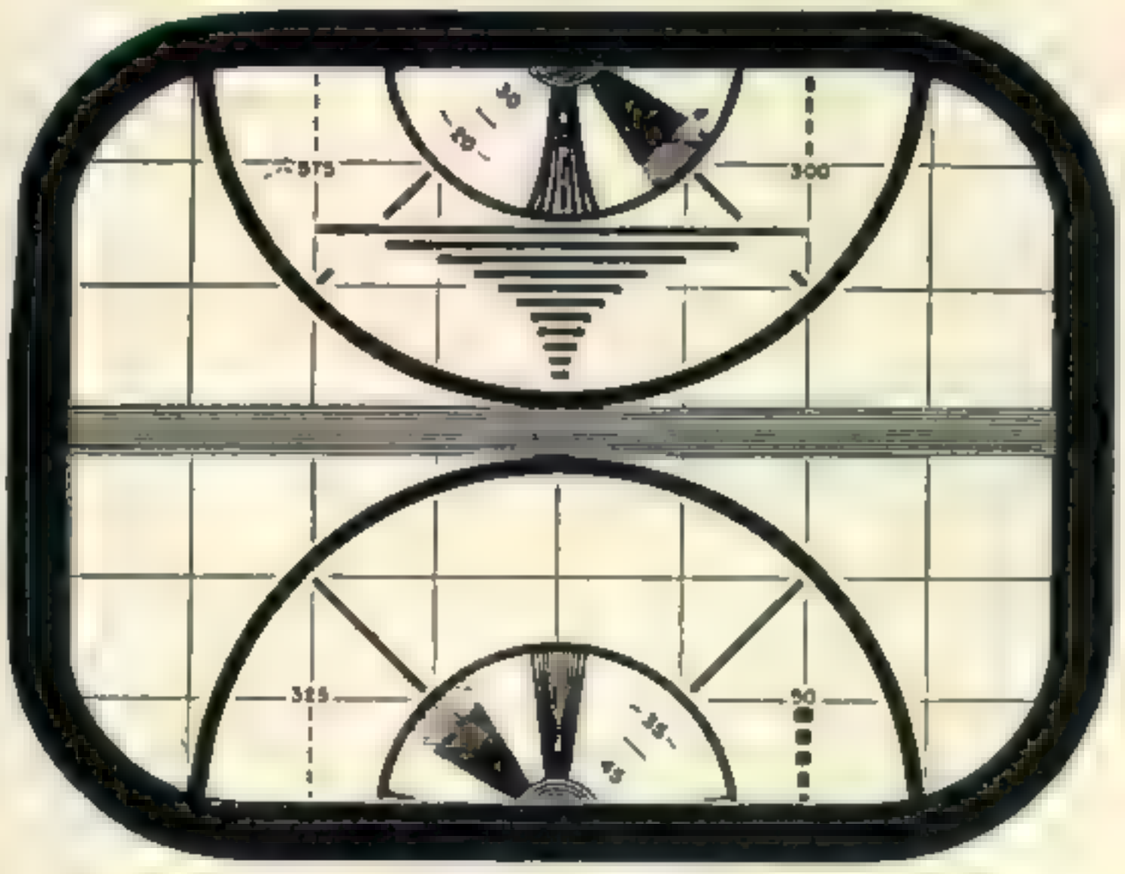


Fig. 3. Vertical movement (slow) up or down.

Fig. 4. Vertical movement (fast) up or down.

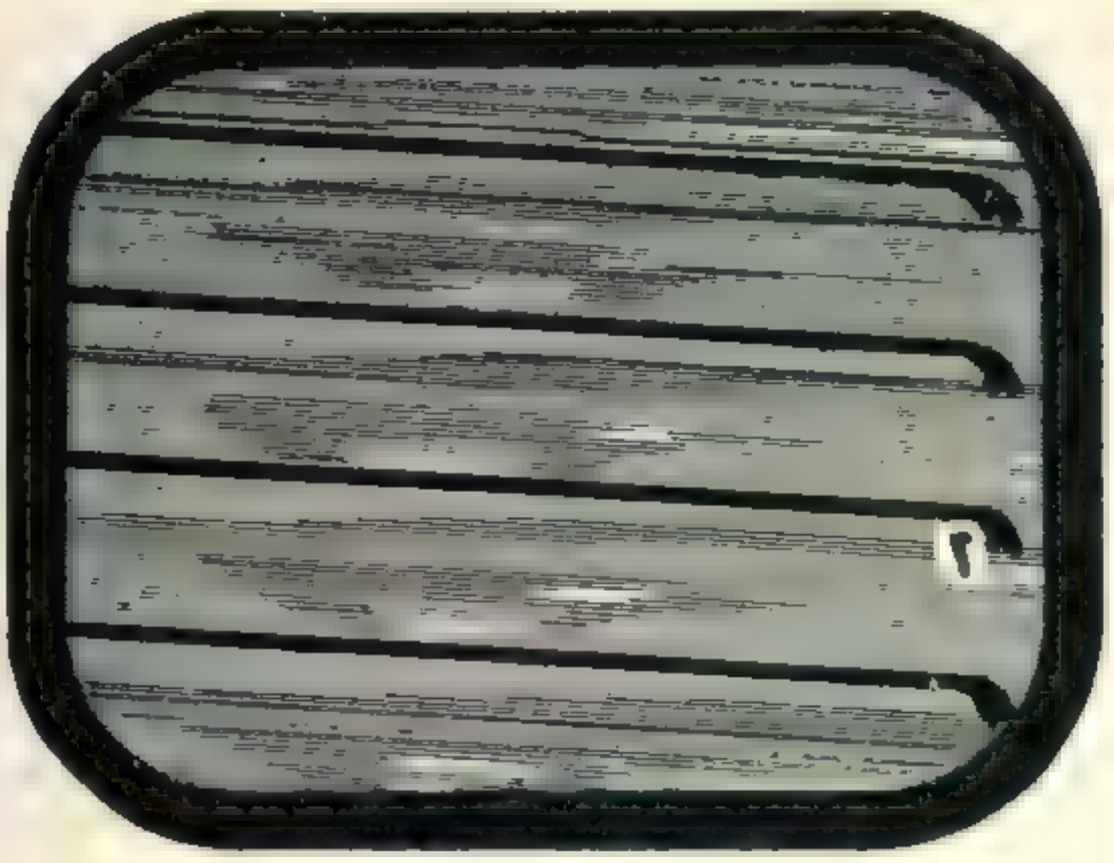


Fig. 5 Horizontal movement (fast), left or right.

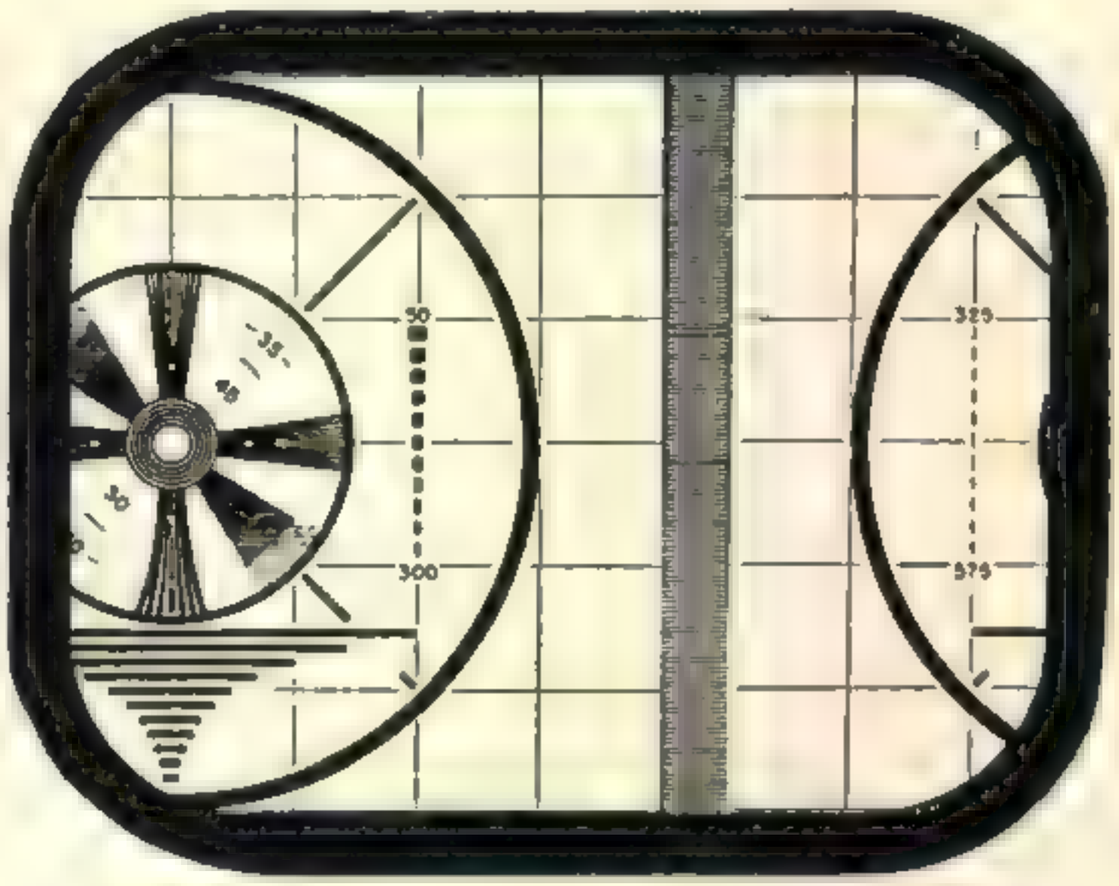


Fig 6. Horizontal movement (slow) left or right.

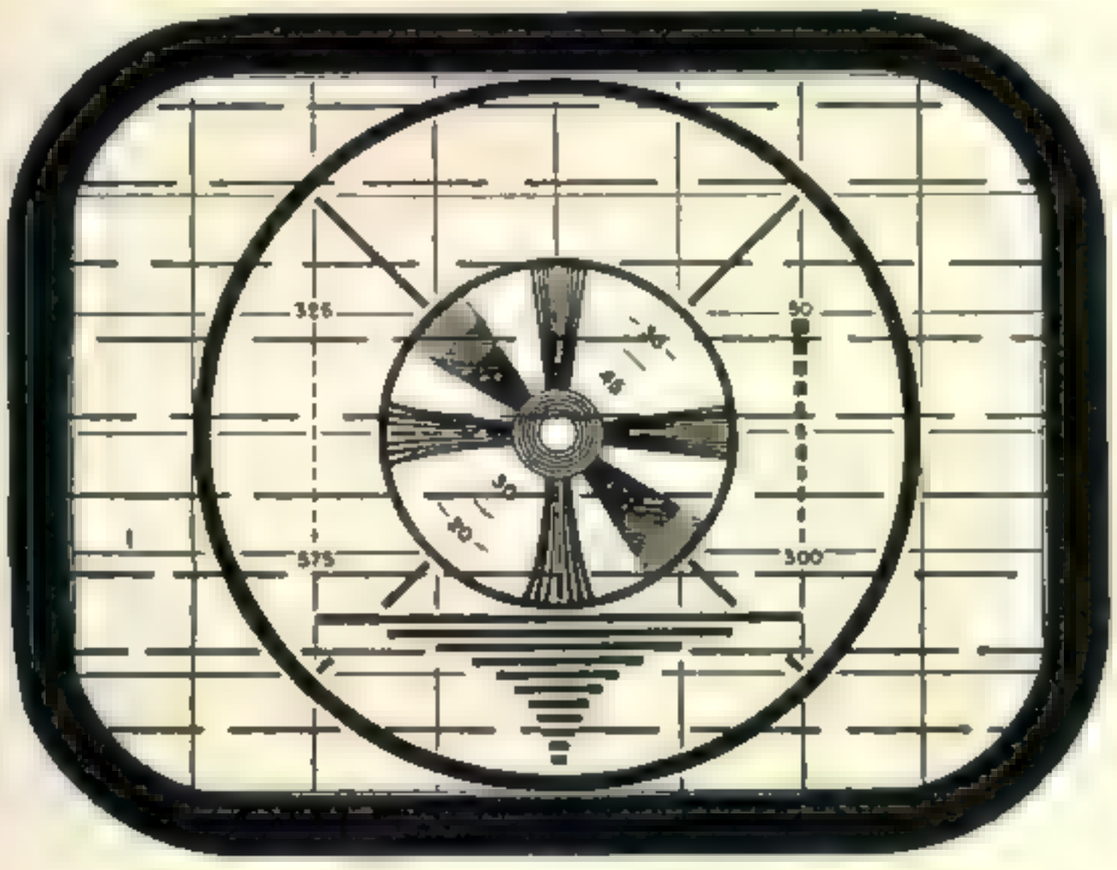


Fig. 7. Ignition interference (light).

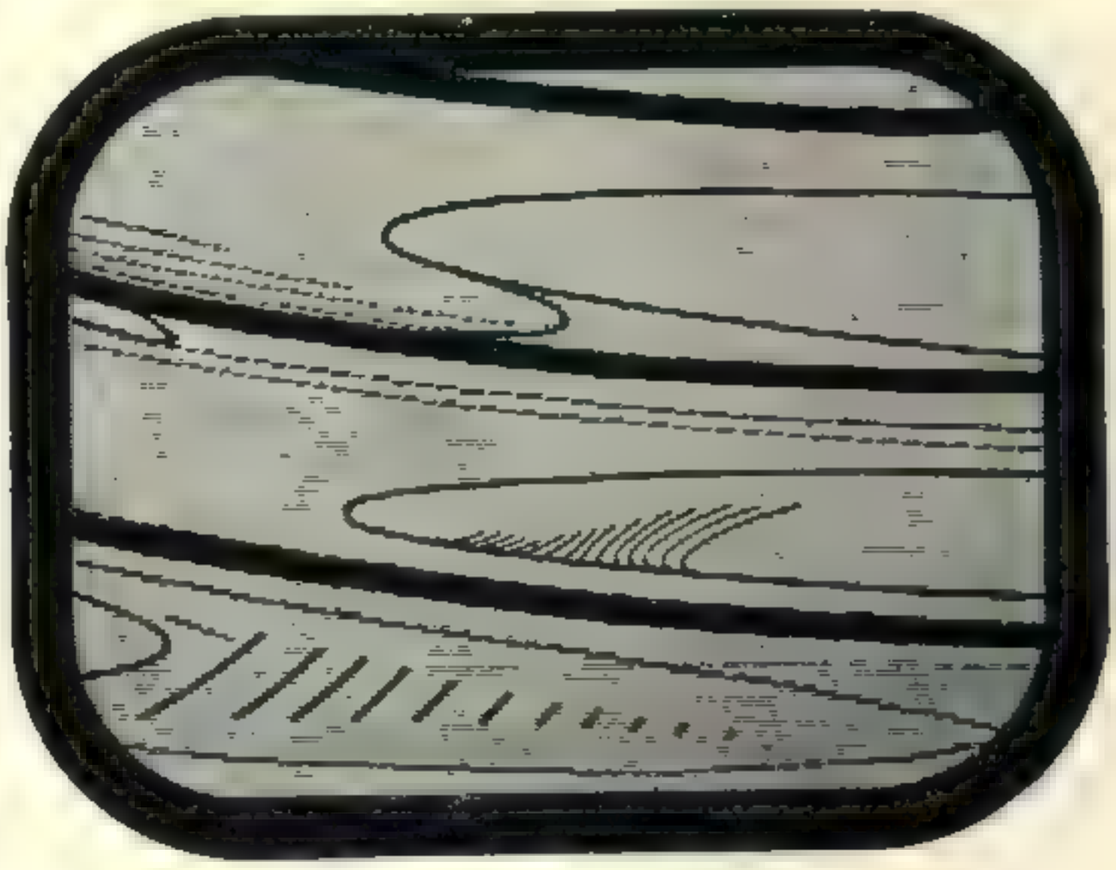


Fig. 8. Ignition interference (heavy).

A careful tabulation of the time and duration of a particular interference generally will permit deduction of its source. Interference from 9 a.m. to 5 p.m. with an hour off for lunch is probably caused by an industrial r-f heating installation, possibly in a molding plant or a wood bonding factory. Interference of 5 or 10 minute duration, starting spasmodically between the hours of 1 to 3 p.m. and between 7 and 9 p.m., can probably be traced to a local medical diathermy machine. Do not contact the possible operators of the believed culprit until the interference has been logged for a few days. When you call, do so when the interference is on, and after inquiring if "so and so" has "such and such" operating, ask that it be turned off momentarily, or that you be advised as it is being turned off.

Mistuning or maladjustment of the receiver will

Fig. 9. Diathermy interference.

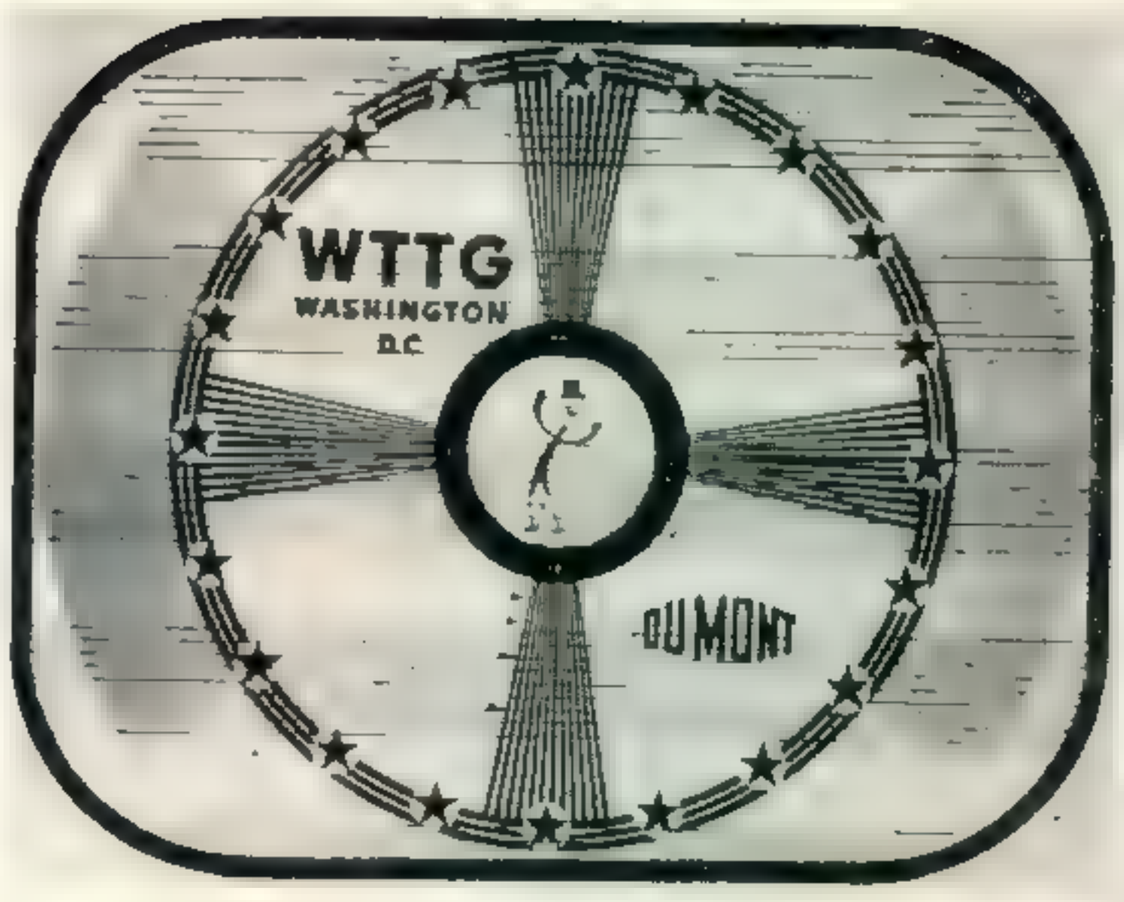


Fig. 10. Sound modulation in the picture channel.

produce a pattern like that shown in *Fig. 10.* This is sound modulation in the picture channel. If our transmitter is off the air, and minor retuning of the receiver removes the effect, we are obviously in the clear on this one. If retuning does not completely remove the effect, but only diminishes it, the sound traps may be out of alignment. Unless the amateur has had a great deal of experience with TV receivers, he shouldn't tackle that job. However, by now we know it isn't our fault, and we suggest that a competent service man be called in to check the set's operation.

Figure 11 shows a pattern caused by r-f interference (a variation of this type of TVI is shown in Part I of the series). This is usually the kind of interference we can cause, although other services, such as aircraft and airport towers do the same. The bars can be widely or closely spaced, they can be thick or thin and can be horizontal, vertical or slanting. To determine whether we are causing this pattern, repeat the procedure outlined under loss of synchronization, correlating the appearance of the bars with the emissions from our transmitter.

By now we can see that we are potentially responsible for only a small part of the possible TVI. However, if one of the indications described above can be correlated with our own operation, it's up to us to track down the cause and eliminate it *as far as possible.* It is not always possible to eliminate TVI completely although we take all possible precautions and use good engineering practice at our transmitter. Sometimes the inherent design of the receiver is at fault due to poor image or i-f rejection, sync circuit susceptibility to impulse noise, unshielded video amplifiers, pick-up by kinescope grid leads, and direct grid or cathode antenna input, etc.

The first attack should be made at the transmitter, using the methods suggested by W2GWE, to clear our own equipment of spurious radiations and reduce our spurious emissions to a minimum.

Eliminating TVI at the Receiver

Next, let's examine the receiver and see what can be done at that end, as well as juggle a few figures around and see what results can be expected. The first examination should be made of the antenna system. Has it developed middle age droop so that the elements are no longer parallel? Has it been blown around by the wind so that it faces your skywire rather than the television transmitter? Was it originally installed at ground level rather than on the roof? Can it be oriented so that you are in its null? An improvement of signal-to-interference ratio can work wonders. The degree of interference de-

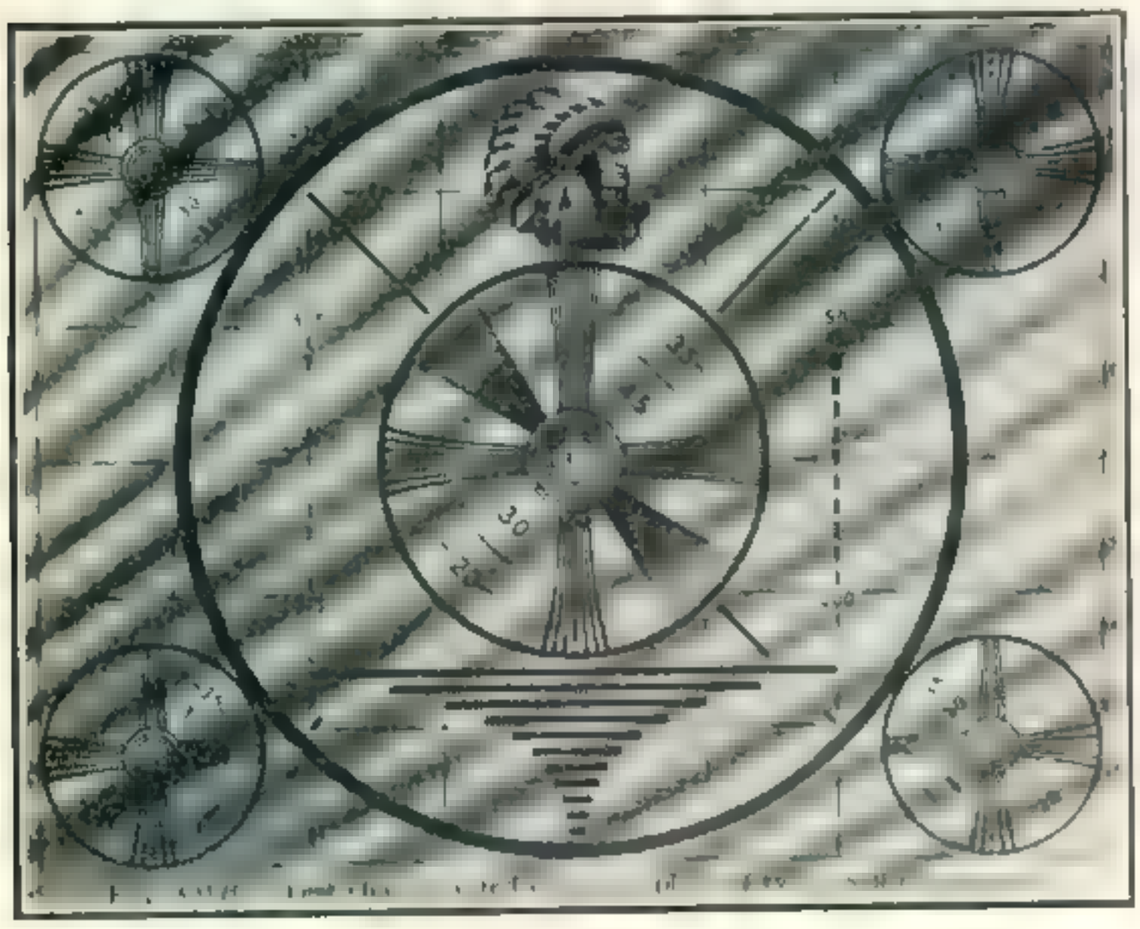


Fig. 11. R-F QRM such as might be caused by hams.

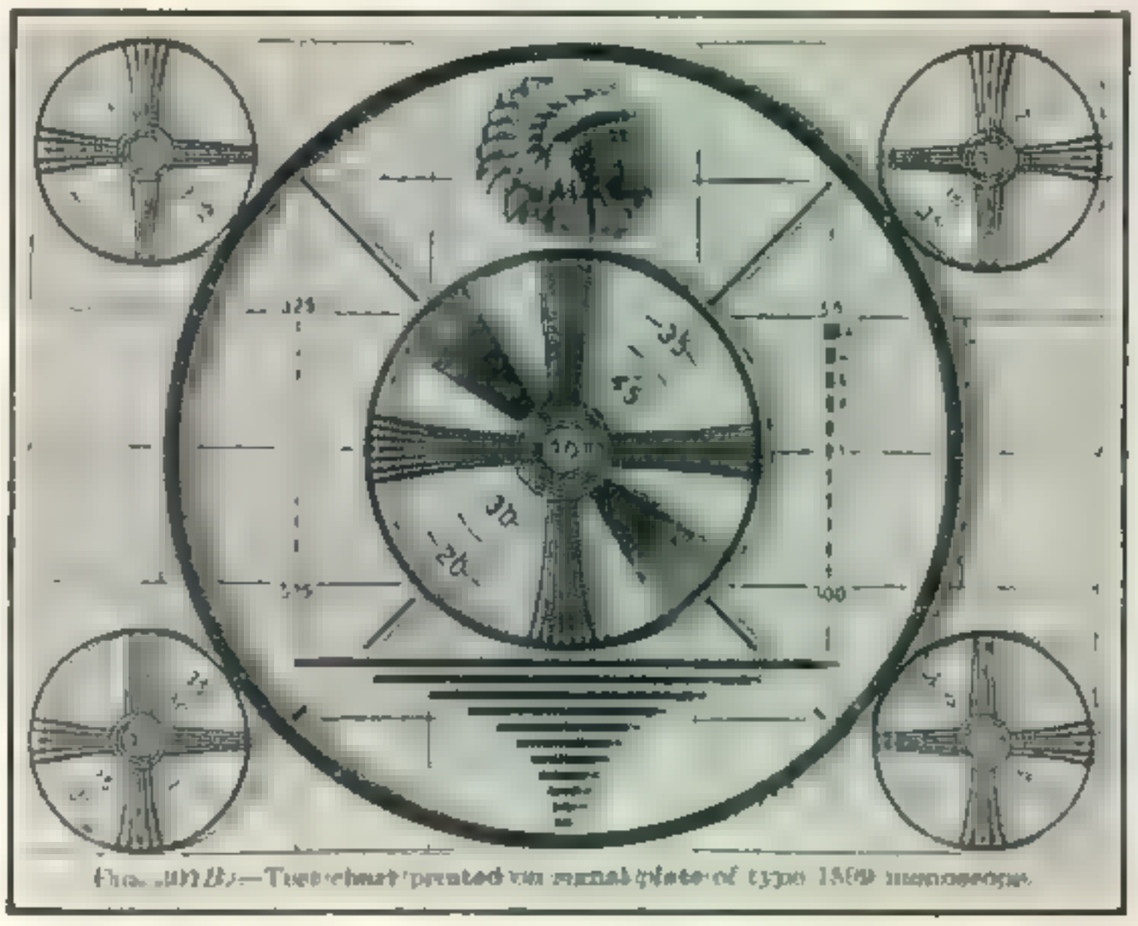


Fig. 12. "Ghosts" (multiple image reflection).

pends upon this ratio. It is generally recognized that an interfering signal should be approximately 40 db below the desired signal to be tolerable. This depends upon the beat frequency resulting from the spurious emission, where that is responsible, and the desired signal. On channel 2, the picture carrier frequency is 55.25 mc. A transmitter operating from 14.0 to 14.4 mc will have a fourth harmonic of 56.0 to 57.6 mc. This produces a beat frequency of .75 to 2.35 mc, which requires a greater attenuation to be tolerable, than an interfering signal having a higher beat frequency. This type of interference causes 50 to 150 parallel black bars which are superimposed on the picture. The permissible power at the fundamental frequency, assuming a suburban location 15 miles away from a 5-kw television transmitter with an antenna height of 500 feet can be calculated.

This would correspond to a field intensity of 5 millivolts per meter. The power across the 300-ohm input of the receiver is $\frac{E^2}{R} = \frac{(.005)^2}{300} = .08$ microwatts. The interfering signal must be at least 40 db or 1/10,000 of this signal to be tolerable = .000008 *microwatts* of harmonic radiation at the television receiver input. If our transmitter is located 50 feet away from the receiver, the space attenuation is approximately 40 db or 10,000 × .000008 = .08 microwatts of the harmonic at the antenna. Assuming a harmonic reduction of 60 db at our transmitter the fundamental 14 mc power cannot be greater than 1,000,000 times .08 microwatts or .08 watts. This should give the reader some idea of the seriousness of the situation. A 14-mc signal with a radiated power greater than .07 watts at a distance of 50 feet from a television receiver can cause objectionable interference in channel 2. Where operation is at the high end of the band, a higher frequency beat results, which would then permit a power of the order of 8 watts at the fundamental for the same degree of objectionable interference.

One remedy for this type of interference is the careful tuning of the adjacent channel sound trap in the receiver to the harmonic frequency. The F.C.C. channel assignments for TV stations are such that these traps are usually not required for their intended use. This has made a remarkable change in certain instances. It is recommended that the TV service man make the actual adjustment while your transmitter is on the air.

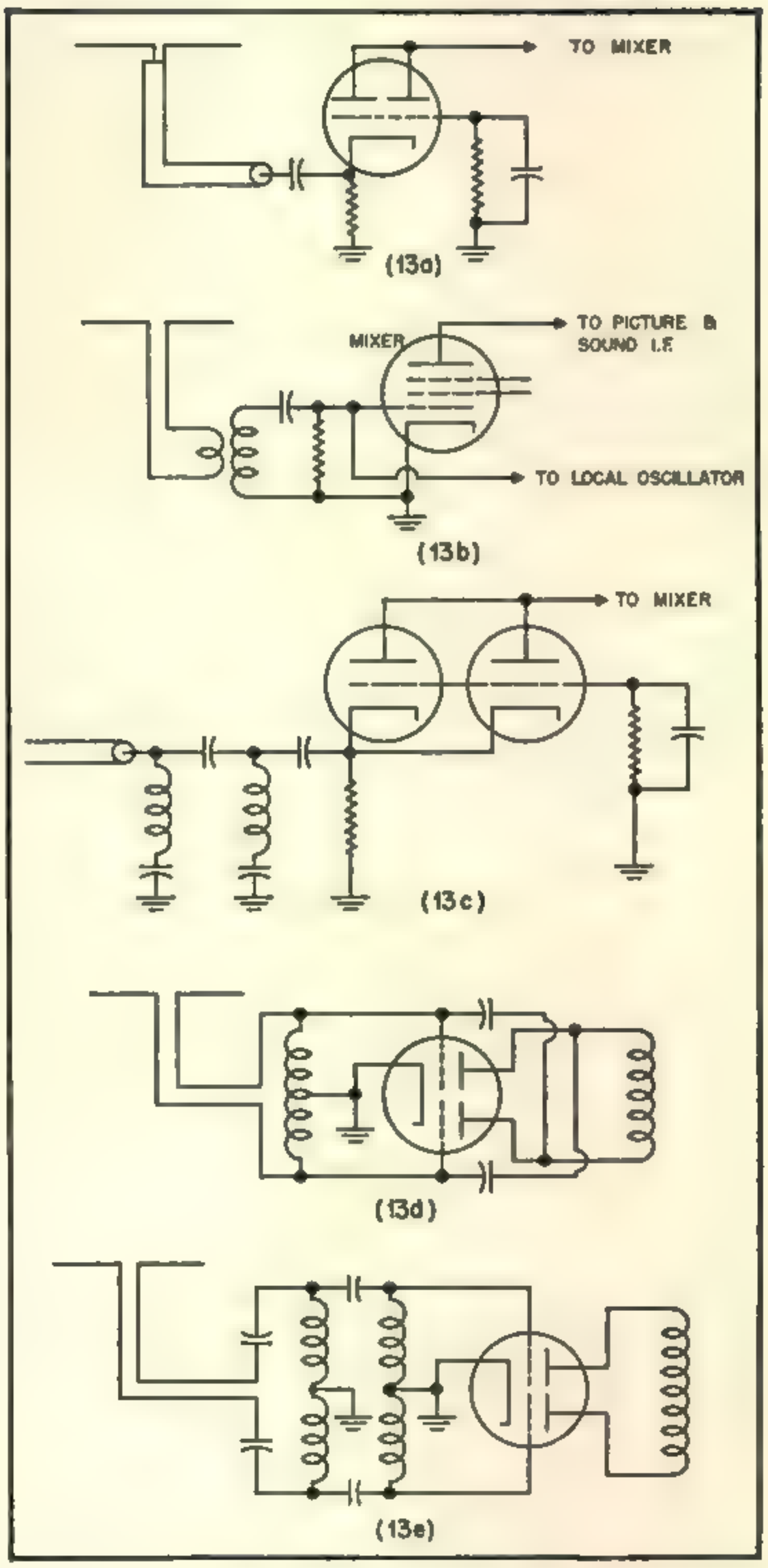


Fig. 13a & b. Two typical receiver input circuits wide open for direct grid pickup. Fig. 13c. Insertion of a high-pass filter in series with the antenna lead will reduce this type of TVI. Fig. 13d. Balanced input circuit is less susceptable to TVI. Fig. 13e. Direct grid pickup in balanced input may be reduced by using a balanced high-pass filter designed for low-frequency cutoff at 50 mc.

TVI Not From Direct Harmonic Radiation

So far we have discussed only the effects of direct harmonic radiation from the transmitter. There are other ways a signal can cause TVI. Signals from 3.5-mc transmitters can be picked up directly on unshielded video amplifier leads or kinescope grid leads. The cure for this is out of our hands since it is entirely a receiver design problem. Strong 14 and 28-mc signals directly on the mixer grid (in receivers without r-f amplifier stages) can cause i-f interference either directly or by the generation of harmonics in the r-f amplifier or mixer tube. Cross modulation can then take place with resultant interference. An examination of typical input circuits can show us how some of this interference can be eliminated.

Some prewar receivers and many of the receivers sold in kit form are the offenders as far as direct grid pickup is concerned (*Fig. 13a & b*). Harmonics in this case can be generated inside the tube itself and are then amplified by the i-f amplifier and appear on the viewing screen. This type of interference cannot be changed by tuning the receiver. It stays substantially the same without regard for the channel in use. One remedy for this type of interference is the

(*Continued on page* 90)

You *Can* Live with Television!

H. M. BACH, Jr. W2GWE*

PART II—Continuing the discussion of the general causes of television interference by amateurs, and the methods of eliminating this interference.

It was shown in Part I[1] that harmonic frequency currents are generated by all tubes of the transmitter that do not operate Class A. Since an electromagnetic wave is radiated when r-f conduction or displacement currents flow, certain rules were developed to minimize the undesired harmonic radiation.

Direct radiation is minimized by providing short low-inductance paths for the harmonic components to follow from plate to cathode. Extreme care must be taken to prevent harmonic currents from following long indirect paths to ground such as feeder wires, power lines, and the like.

The practice of employing adequate r-f filtering of all power leads is highly recommended. Comprehensive shielding of the transmitter likewise is excellent practice. However, to do a first class job of filtering and shielding mandates a complete and major redesigning and rebuilding of the transmitter. It is beyond the scope of this present article to treat the subject fully. In subsequent articles we will describe in detail several transmitters that we feel to be as free of spurious emissions as the present knowledge of the art permits. Practical shielding and r-f filtering techniques will be discussed in detail in these subsequent papers.

Shielding

We have seen that electric energy can be radiated directly or can be developed on conductors in the immediate vicinity of the transmitter which in turn can effect radiation in three ways, by an electric field, by a magnetic field, and by conductors conveying a current which in turn may produce electric and magnetic fields. It is the purpose of shielding to confine, or bottle up, the electric energy within the shielded space and this is accomplished by blocking completely all ways of propagation.

The electric fields are produced by potential differences which, for example, exist between various components in any stage of the transmitter and the chassis. The placement of all the components of a single stage, or a group of stages within a shielding box, one side of which is the chassis, confines the electric field within the box. Even if the box contains holes, or slots, or is constructed of wire screening the shielding of the electric field is still almost complete, provided the resistivity of the metal making up the box is very small. In the frequency range of our fundamental and harmonics, copper and aluminum are entirely satisfactory shielding materials for the electric field. Copper screening is satisfactory if it is bonded to copper strips at the edges, in order to insure good low resistance contact to each wire of the netting despite faulty contact between individual wires occasioned by oxides forming on the wire.

Magnetic fields, generally speaking, are produced by the flow of current along a conductor. Because radio frequency currents flow on the surface of a conductor, and do not penetrate into the metal (skin effect) no magnetic field can be produced external to a solid metal box by a magnetic field inside the box, regardless of whether the box is grounded or not. Strong currents flow on the inner surface of the box, generating a second magnetic field of such magnitude to exactly neutralize the first internal field and make the total field external to the box zero.

Small holes in the box permit the penetration of the magnetic field to the outside, although the total field through a hole is zero. The magnitude of the flux penetrating a hole is a function of the diameter of the hole, and for small holes external flux exists only in the immediate vicinity of the hole. Slots, even if they are quite narrow, can be extremely dangerous if the magnetic lines of force are parallel to the long dimension of the slot. If the lines of force are parallel to the width of the slot, the slot will be no more harmful than a row of holes. Because it is extremely difficult to predict the direction of the lines of force within a compartment containing an entire stage or several stages of a transmitter, slots in shielding should be avoided and small holes, necessary for cooling should be carefully located with respect to the components. Because there may be a relatively high resistance contact at the junction of the major surfaces comprising the box, and such a junction permits leakage as if it were a long narrow slot, complete solder bonding or the placement of securing screws very close together is mandatory if the shielding is to be completely effective. Inasmuch as the box has to be opened to change plug-in coils, substantial pressure should be employed along the junctions in order to insure good contact, and to do the best job. Individual secondary shields around components that produce a large magnetic field may be employed. Because we are shielding against harmonics, and we know how to avoid the flow of harmonic current through the tank coils, this type of secondary shielding is generally not necessary.

Everything considered, we suggest the employment of only moderately effective box shielding because of the importance of providing good ventilation within the transmitter, but to employ two of

* *36 Woodmere Blvd. S., Woodmere, L. I., N. Y.*
[1] *CQ*, June, 1948.

such moderately effective shields. In the case even of the high-powered stage, the use of a rather generous number of small holes for ventilation in each of two shields, one completely confined within the other, and spaced of the order of 4–6 inches, is completely effective. In the "KW TVI Special" single shielding is employed and then the entire rig is contained in a specially designed enclosed rack that serves as a second shield. The magnetic field produced external to such an arrangement is inconsequential. Incidentally, the use of steel for such shielding purposes is rather inferior, and the employment of aluminum provides greatly enhanced results. This problem has been discussed with certain of the suppliers of amateur racks, panels, and chassis, and specially designed components such as used in the forthcoming article describing the new kw rig will soon be generally available.

Conductors conveying r-f currents are very potent sources of undesired radiation, and leads leaving the shielded box must be at the same potential as the outside of the box. We have found that the most effective and easy method of accomplishing this is to employ an additional relatively small shield box containing individual shield compartments. Each compartment (one for each lead) contains properly designed low-pass filters, and each lead coming from the large shield box is brought out via the small box which is bolted to the large box. Of course, the r-f output from the large box is not brought out through the small box. The employment of coaxial cable for all r-f interconnecting cables is strongly recommended, and a shielded low-pass filter designed to cut off just above the highest frequency that is generated within the box is excellent practice. For example, if the exciter within the box provides output from 3.5 mc to 30 mc, then a shielded low-pass filter passing all frequencies below, say 32 mc, would be interposed in the output connection.

It will be appreciated by the reader that, unavoidably, the mechanical design of an adequately shielded transmitter is such as not to provide ready accessibility. However, it is important to realize that the amateur transmitter of today and tomorrow must be denude of spurious emissions, and the pattern followed for the past 20 years without any major evolutions is passé.

The truly modern approach is to employ a low power, completely bandswitching and bandpass exciter followed by a high-gain high-power pentode stage as the final, or followed by a high-gain medium-power pentode as a driver for a triode PA. Such an electrical design readily permits the necessary mechanical arrangements above discussed, and the finished equipment is as shorn of spurious emissions as possible.

Parasitics

In Part I and so far in Part II of this article, it has been shown how harmonic currents are generated. We have then turned our attention to the minimizing of harmonic radiation by the employment of certain definite electrical and mechanical techniques. As stated in Part I, the presence of amateur emissions in TV channels can arise from other than harmonic causes. Just as potent an offender may be the generation of parasitic oscillations in the transmitter. If parasitics are present, their radiation will naturally be minimized by the same measures that minimize harmonic emissions. However, it is important to realize that while harmonic generation is unavoidable, and that precautionary measures can *attenuate* the radiated harmonic power to a sufficiently low level to avoid general TV interference, parasitic generation is completely avoidable, and can be *all together eliminated* directly in the offending stage of the transmitter.

Since parasitic oscillations are potentially present in any stage unless the stage has been previously purged of them, it is absolutely necessary to investigate each stage for their presence.

A recommended procedure for checking for parasitics is to remove plate and filament power from all but the stage to be investigated. The bias on the suspected tube should be sufficiently low to provide highest possible transconductance without endangering tube life through excessive plate dissipation. In most cases, it is better to reduce the plate voltage in order to obtain high plate current (and high gm) at a reasonable plate dissipation. We recommend only *momentary* application of plate voltage with suitable grid bias to provide plate current flow corresponding to not greater than 150% of rated maximum plate dissipation. If a parasitic condition exists it will be readily observed either by a flow of grid current, or by plate current reading substantially different from that value given on the static curves supplied by the tube manufacturer, or by the ionizing of a neon filled bulb located in proximity to a tube electrode. In using a neon bulb indicator, be

The rapidly increasing popularity of television is graphically illustrated in this photograph of the television antennas occupying just a small portion o one apartment house in New York City.

careful to check all tube terminals since any one electrode may be at ground potential at the parasitic frequency. Except in rare instances, parasitic oscillations are not a function of the tuning of the plate or grid condenser. Oscillations that are a function of the adjustment of the grid or plate condenser generally are produced by grid/plate feedback, and can only be eliminated by improved isolation between input and output circuits, either by more perfect neutralization, shielding, etc.

Elimination of parasitic oscillations has been adequately treated in the available technical literature. Briefly, the attack is to locate the frequency of the parasitic, to deduce the circuitry that is serving as the tank circuit, and to rearrange the lead lengths, and/or to add suitable RL suppressors or detuning inductances that effectively are in the tank circuit at the parasitic frequency, but have little or no effect upon desired operation of the stage.

Spurious FM components may be readily generated by a stage that has a parasite or self-oscillation. Although under the normal condition of high excitation the stage appears to behave properly, it will be found that during build-up or decay at key make or break, momentary oscillation occurs at a spurious frequency. The frequency of the offending stage abruptly swings from the spurious to the desired frequency, and sidebands of this "FM" are generated that have components extending over a substantial spectrum. We have actually logged amateur stations with click and-or "mush" bands extending one hundred or more kc each five hundred kc for one or two megacycles, produced by such improper transmitter operation. The modulated amplifier of a phone transmitter may only break into parasitic oscillation over a portion of the modulating cycle, but the steep-sided FM sidebands thus generated may have hash components that cause serious interference over a wide spectrum.

Careful stage by stage investigation as outlined above will locate the frequencies of the inevitable parasites and by diligent work on the isolated stage complete elimination may be achieved.

Improperly shaped keying impulses may give rise to spurious emissions. It is felt that the importance of shaping that provides a sloping leading and lagging edge with a reasonably rounded top cannot be over-emphasized. That too many amateurs are ignorant of how poorly their keyed impulses are shaped is attested by the click infested c-w bands. With bug sending a keyed c-w signal that is not shaped can easily give rise to sidebands (in the form of clicks) that occupy more space than a voice transmitter. While clicks produced by a condition of partial self-oscillation are considerably more to blame for the conditions that play havoc with television receiver sync circuits, clicks caused by improperly shaped keying impulses likewise must be eliminated. Methods of obtaining properly rounded keyed impulses have been adequately discussed in the literature and the reader is referred to the excellent articles in *CQ*[2] treating the subject.

"Hopeless Cases"

It is unfortunate that to do a complete job of minimizing emissions in the TV channels requires such a substantial amount of work. Sad to relate, it must be stated that even after careful compliance with all of the above under certain conditions, TVI may exist.

The degree of permissible interference is a function of the frequency difference between the desired video carrier frequency and the frequency of the interfering signal. Generally speaking, ratios of better than 40 db are required with beating frequencies of the order of one to two megacycles. Accordingly, therefore, the permissible spurious emission in each television channel may be readily calculated from a knowledge of the field strength

(*Continued on page 89*)

[2] Seybold, "Clickless Keying Using VR Tubes," *CQ*, May 1948.

"In the Commission's Notice of Proposed Rule Making the television channel proposed for deletion was No. 1. At the hearing the American Radio Relay League recommended that channel No. 2 be deleted. The League based this recommendation on the fact that the harmonics of an amateur band and of industrial, scientific and medical devices would fall in channel No. 2 and largely destroy its usefulness. The League further pointed out that improvements in receiver design can obviate or minimize adjacent channel problems but that no change in receiver design will eliminate the effects of harmonics; the harmonics must be suppressed. The arguments advanced by the League have considerable merit and have been carefully considered. The Commission has concluded that no perfect solution exists. On the whole many of the problems in this portion of the spectrum are the result of the interspersed nature of the frequency allocations. If television channel No. 1 is deleted, channels 2 through 6 are substantially one block. If television channel No. 2 is deleted, and channel No. 1 is retained, there will be boundary problems for two channels; channel No. 1 will have adjacent channel interference on two sides and channel No. 3 will have it on one side. Viewing all factors the Commission finds that a better allocation will result if television channel No. 1 is deleted. Representatives of the television industry were also of the same opinion.

The Commission is aware of the fact that this decision, meaning as it does that every effort will have to be made to suppress harmonics as much as possible, will cause some misgivings to the amateurs operating in the 28-29.7 mc band whose harmonics may cause interference to television channel 2. The Commission believes that harmonic interference problems are to be expected generally throughout the upper spectrum and Commission Rules requiring harmonic suppression will be equitable in their application to the several services. Moreover, a degree of harmonic suppression will not be required of amateurs which is unrealistic or not applicable to other services, considering the peculiarities of each such service."

From the F.C.C. Report and Order Docket Number 8487 based upon the testimony and exibits presented during the hearing Nov. 17 to 21, 1947, relating to frequency allocations in the bands 44-88 mc and 174-216 mc.

Grounded-Grid V.F.O. Coupling Amplifier

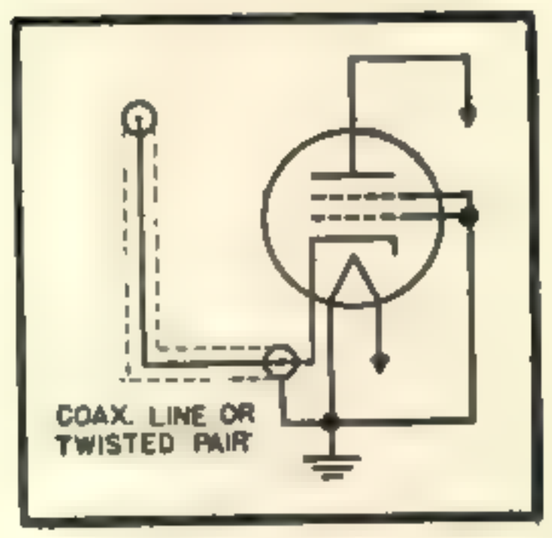


Fig. 1. Circuit of the v-f-o coupling amplifier.

EUGENE BLACK, W2ESO*

Coupling a v.f.o. to an already-built transmitter has always been one of ham radio's minor problems. Here's one easy way out.

THIS LITTLE brainstorm was originally intended to be part of the write-up on the T9'er,[1] but since it is equally useful for the 'phone man, where the T9'er is of interest mainly to the c-w operator, the idea is worth presenting separately.

The circuit of the v-f-o coupling amplifier is illustrated in *Fig. 1*, two different built-up versions of which are shown in the accompanying photograph. What it does is to let you couple your v.f.o., NBFM exciter, etc., to your existing transmitter (1) without having to add an additional tuned circuit; (2) without having to disturb any wiring or remove any crystals; (3) without having to neutralize anything or worry about the former crystal oscillator taking off by itself; (4) without having to add protective bias to the former crystal stage to protect it during key-up periods if break-in c.w. is used, all this with a worth-while power gain. The transmitter can be returned to its previous method of operation at any time by removing the coupling amplifier and replacing the original crystal oscillator tube in its socket.

The high-mu triode connection of the 6L6 (any beam tetrode or pentode can be used) takes care of the no-bias requirements, at the same time removing the usual tendencies toward parasitics, while the low impedance cathode input circuit removes the need for a tuned input tank and for neutralization as a straight amplifier.

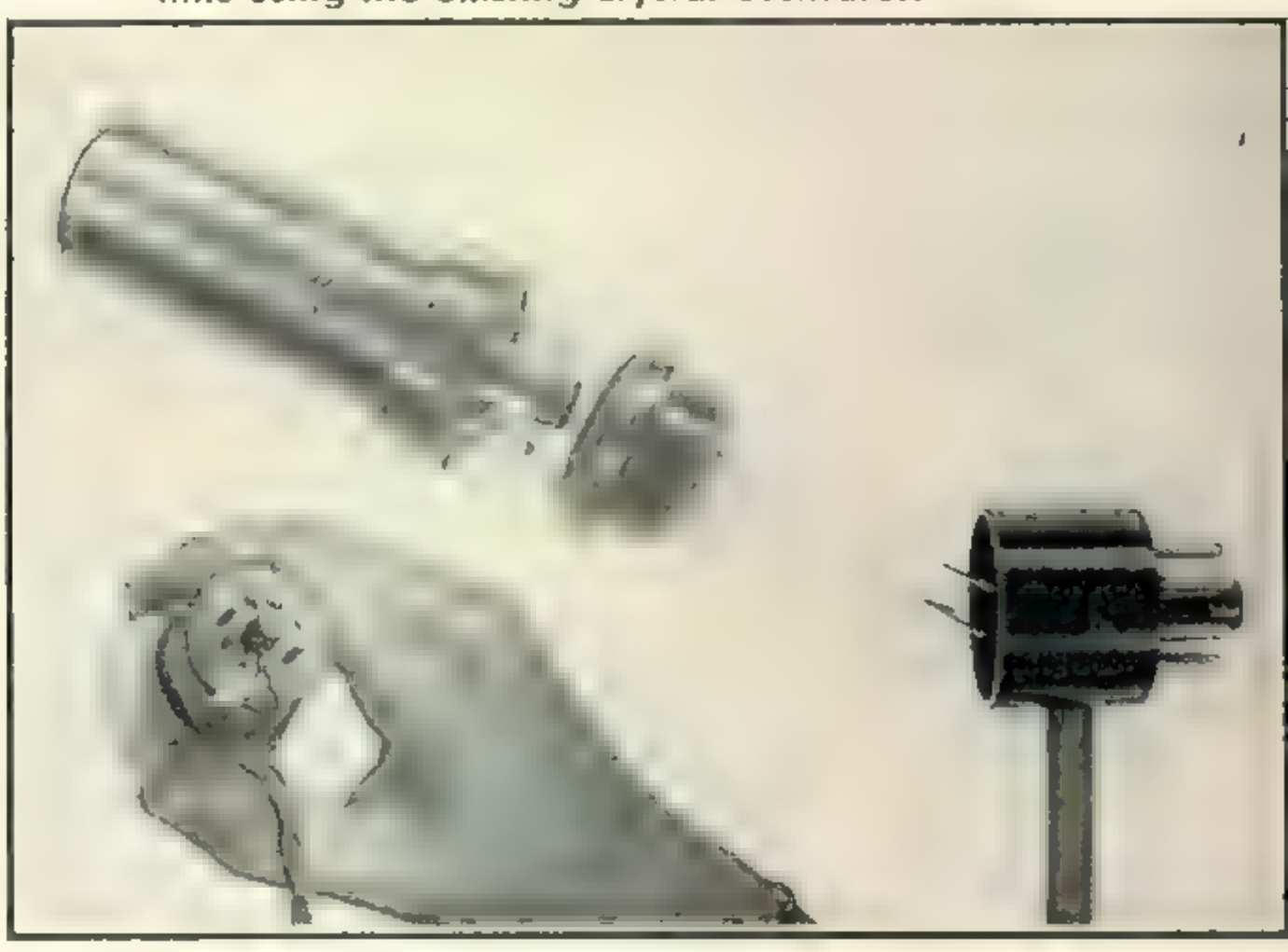
While the tube is intended primarily to serve as a straight amplifier, some output can be obtained as a doubler as it stands. If doubling were required at all times, it would probably be worth while to experiment with some added grid leak bias, although this has not been tried. One possible arrangement would be to continue returning the screen to ground, but adding a resistor between grid and ground, bypassed for r.f.

The 6L6G in *Fig. 2*, was altered by carefully splitting and spreading the cathode pin (No. 8), the screen (No. 4) and the control grid pin (No. 5). The screen and grid were strapped together to a jumper soldered to a lug sweated onto the ground pin (No. 1), while the twisted pair lead carrying the r-f excitation was anchored to the tube base with Scotch tape and connected to the cathode lead and to the lug on pin No. 1. The only precaution is to insure that pin No. 1 on the crystal oscillator tube socket is actually grounded, although a good ground connection between the v.f.o. or NBFM exciter and the main part of the rig is also advisable.

A more permanant installation that permits the changing of a defective tube may be constructed from a standard octal socket adapter such as the Amphenol 3-14D. The adapter can be easily removed and the tube reinserted in the socket for crystal operation.

The tube mentioned above is still in use after nearly 8 years. With a 400-volt supply and no excitation, the cathode current is less than 10 milliamperes, while when driven by the T9'er, cathode current when loaded runs about 90 ma. Power output seems comparable to that of the conventional grid-input stage.

Fig. 2. Lower left: A 69-cent (prewar prices) bargain 6L6G, still going strong after 8 years of a cut-up existence. Top: A deluxe version, made from an Amphenol adapter. This saves mangling a tube and permits using the existing crystal oscillator.



* *449 West 56th St., New York 19, N. Y.*

1 Black, "The T9'er," *CQ*, April, 1948.

V-H-F Ground Wave DX

OLIVER P. FERRELL*

The application of the Booker Mode Theory of Tropospheric Refraction may answer the question of maximum signal ranges possible with the aid of superrefraction, at 6 and 2 meters.

OF ALL THE v-h-f transmission phenomena the most misunderstood is the super-refractive duct. Attempting to explain unusual 2-meter band propagation in terms of the duct have so far been unsatisfactory. However, it was noted that we can ascribe this to several important factors. First, there is actually very little known concerning the transmission of radio signals through atmospheric ducts. Secondly, most published information available to the ham is either extremely complicated and purely theoretical, or is a simple development of the meteorological influence. Last, but by far not the least important, is the concept generally held by the amateur that the duct is practically synonymous with the metallic waveguide. This infers that the duct has a very sharp frequency cutoff characteristic determined by its size. While this is in part true, it has at the same time been greatly exaggerated.

All non-ionospheric v-h-f and u-h-f propagation beyond the horizon is due to the departure of the index of atmospheric refraction from the normal values created by the temperature and humidity directly above the surface of the earth. Since both parameters decrease with increasing height there will be a slight amount of refraction even in the standard atmosphere. At times when the temperature increases while the specific humidity simultaneously decreases from the normal values when ascending in altitude there will be a change in the refractive index, tending to bend the radio wave back to earth beyond the horizon. This general effect had been known for a number of years, but until World War II no experimental data had been obtained above the v.h.f. Consequently, it was discovered that meteorological situations often developed that formed extensive areas of refraction at certain levels in the troposphere. These effectively trapped the u-h-f radio wave and permitted communication at distances far beyond the horizon of the transmitter. While this duct and v-h-f refraction, or the so-called bending, were undoubtedly related there have been few attempts to bring the two together under the same theoretical heading.

Booker Mode Theory

It was with considerable interest that a study was made of the Booker Mode Theory of Tropospheric Refraction.[1] The attractiveness of this particular theory was the explanation of the transfiguration of tropospheric refraction that takes place with decreasing wavelengths. This was possible since contrary to the sharp frequency cutoff characteristic of

* *Assistant Editor, CQ*

1 A description and some transmission curves may be found in the book *Meterological Factors in Radio-Wave Propagation* published by the Physical Society (England), 1946, pp. 80–127.

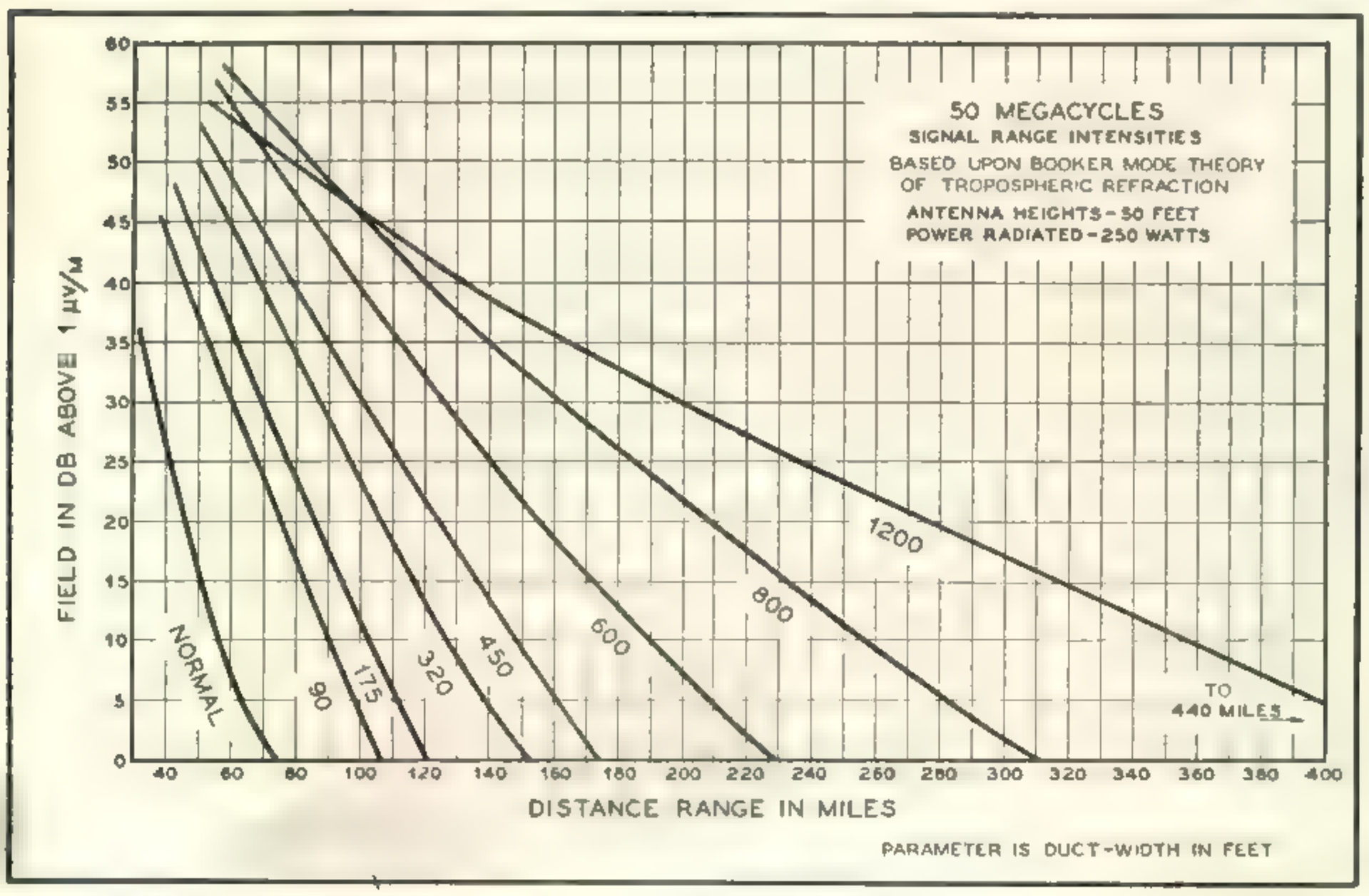


Fig. 1. Distance ranges possible at 6 meters based upon fifth-root profile. Horizontal polarization over smooth earth.

the waveguide it was shown that ducts do materially affect practically all frequencies above 30 mc. The effectiveness of the duct does vary with wave length, but at the same time it may be calculated from appropriate formulae. At the frequencies lower than the cutoff the duct may be said to leak the radio energy, although often extending the ground wave coverage. As the frequency is increased the effects of the fine structure variations in refractive index become more noticeable and there is less leaking from the duct. Thus, the mode theory makes it possible to calculate refractive duct transmission at any frequency.

The mode theory is based upon certain uniformities in the variation of the modified refractive index.[2] If the modified index decreases as we ascend there will be some trapping at all wavelengths. If the index increases beyond the normal value there will be—in extreme cases—a reduction in the normal ground wave coverage. It can be shown that the *track-width* of a certain wavelength must depend upon the ratio of the lapse-rate of actual refractive index to the curvature of the earth. This ratio may be estimated from meteorological data and then becomes a function related to the actual duct-width. Propagation beyond the horizon may be considered to be in the first mode. The mode may then be expressed in a coefficient that shows the degree that particular mode is excited within the duct. Combining the two produces a positive or negative function depending upon whether the track-width of the mode is less than or greater than the duct width. Modes whose track-widths are less than the given duct-width are ones substantially trapped. Track-widths greater than the given duct-width leak the radio energy copiously. When the two are near equal there is a tendency for the mode to be suppressed, an effect which we may some day observe at higher frequencies.

2 *The VHF News*, February, 1948, page 12.

Signal Range Intensities

The signal range intensities derived by the Booker Mode Theory for 6 and 2 meters are shown in *Fig. 1* and *Fig. 2*, respectively. The transmitter at either frequency is assumed to be radiating 250 watts from a dipole 50 feet above ground level. The receiving antenna is also assumed to be 50 feet above ground level. The value of the ordinate is in db above 1 μv/m. The basic value is twice free space, thus, the field at any given distance is approximately the maximum that would be received under nearly idealized conditions.

With the standard atmosphere the *normal* line represents the maximum signal and range to be expected. As indicated by the usual theoretical processes the 6-meter ground wave is somewhat longer than that expected at 2 meters. However, at distances of less than 40 miles the difference in field strength between the two bands is scarcely noticeable, although at very low signal strengths the 6-meter limit is about 11 miles further than that on 2 meters.

The two bands become approximately equal when a minor amount (ducts of about 100 feet) of refraction exists. Beyond this point any further increase in refraction favors the 2-meter band. For a 1 μv/m signal over a path of 120 miles at 50 mc the duct would need to be about 175 feet high, while at 144 mc it need only be about 140 feet in height. Since these are typical duct heights found frequently throughout certain seasons of the year it is to be expected that 2 meters will offer slightly better DX-ing than 6 meters. At ranges of 230 miles the spread in duct-widths (height above ground) becomes quite large with a duct of over 600 feet required at 50 mc, but only 380 feet required at 144 mc. Operators who regularly operate both 6 and 2 meters may now see why the DX ranges are greater at 2 meters than at 6 meters.

Ducts that become large with respect to the oper-

(*Continued on page 88*)

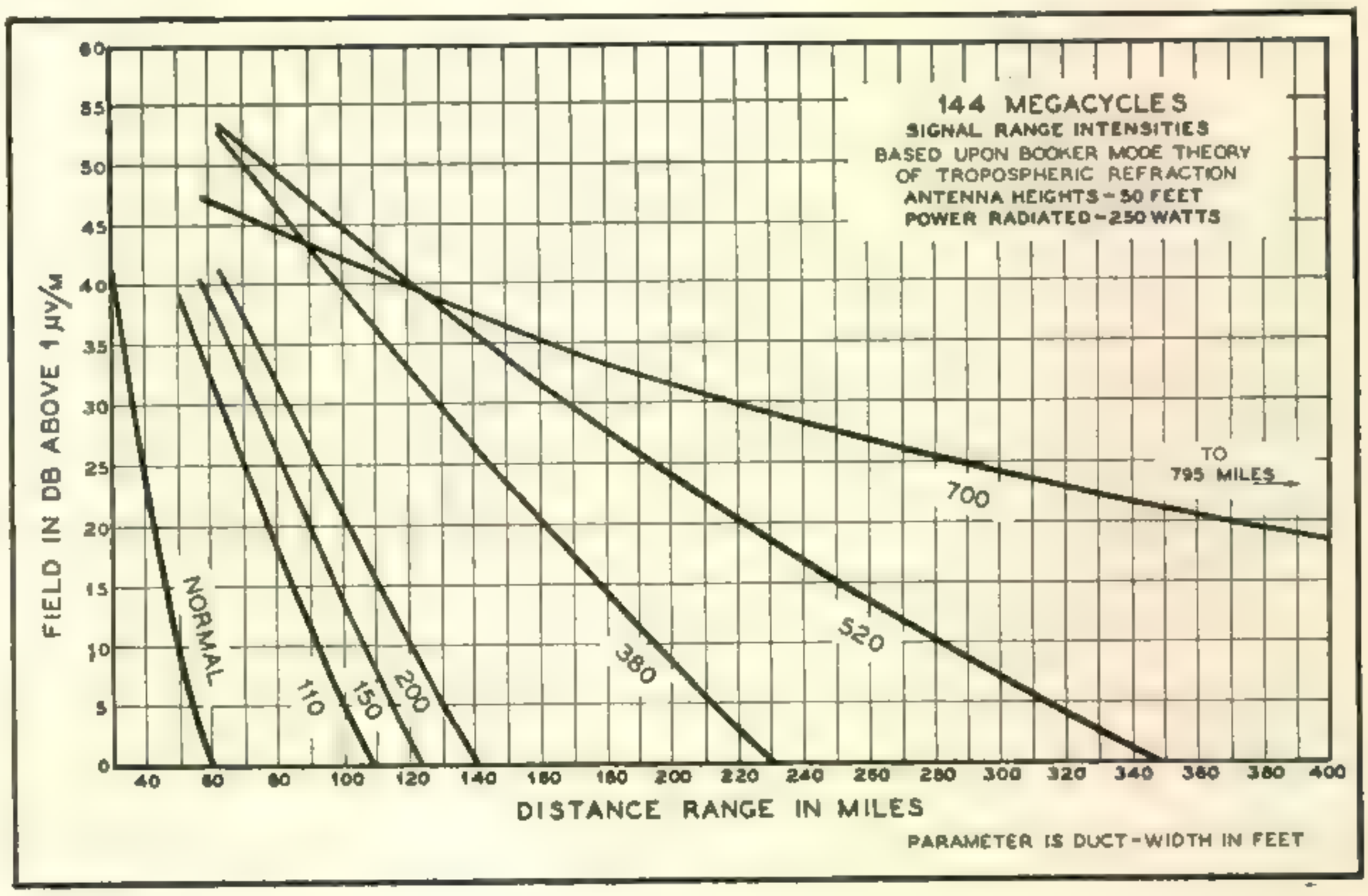


Fig. 2. Distance ranges possible at 2 meters based upon fifth-root profile. Horizontal polarization over smooth earth.

Variations in the Modification

For 80 and 40 Meters

E. B. McINTYRE, W3KHJ*

THE PURPOSE of this article is to describe one possible conversion of the ARC-5, or ATA and SCR-274N into a useful 40 and 80-meter v.f.o. Originally this unit was an aircraft command set and hence used the 24–28 volt d-c supply of the plane as its primary source of power. Unlike many other pieces of surplus equipment these units will operate efficiently with only a minimum of modification. As a matter of fact, so little time was spent in connecting them up that it was decided to rebuild them into a rack and panel unit. Thus, we have the foundation of a good ham station with very little encroachment on our time and expense account.

The Circuit

The ARC-5 transmitters are essentially m.o.p.a. A type 1626 (while the 1626 is a more stable oscillator tube, the 12J5 can be substituted) with the plate grounded for r-f is used as a modified Hartley master oscillator. A pair of 1625 tubes (807 with 12.6-volt filaments) are paralleled and form the final amplifier. Grid neutralization is used in this single-ended final stage with the out-of-phase voltage being fed back into the grid coil through a fixed-tune condenser.

The original aircraft antenna was loaded by a combination of rotary link and loading coil. The antenna connects directly to the loading coil through the relay *K54*. A rotary link is inserted in the final amplifier plate tank and is connected through to the loading coil with a moving tap. The tap on the loading coil is arranged to roll along the turns of the coils as it is turned by means of a gear system that extends through the front panel. This type of coupling is especially useful when loading up a Marconi or end-fed Hertz antenna.[1]

The maximum power output of the transmitter while in the plane is about 40 watts on c.w. and 15 watts output on phone with 100 per cent modulation. The model ATA, however, uses screen modulation and has only a power output of about 10 watts on phone. The modified transmitter uses much higher plate voltages and a maximum power input of between 100 and 150 watts may be expected.

These transmitters also incorporate a 1629 (magic eye tube) which is used as a crystal-controlled calibration oscillator. This oscillator does not control the frequency of the transmitter at any time, but simply acts as a check on the calibration of the master oscillator. Most of the units are supplied with a calibration crystal of 3500 kc (BC-456A unit) or one of 8870 kc (BC-459A unit).

Electrical Modifications

Certain modifications should be made before the transmitter is put into operation. These modifications are as follows:

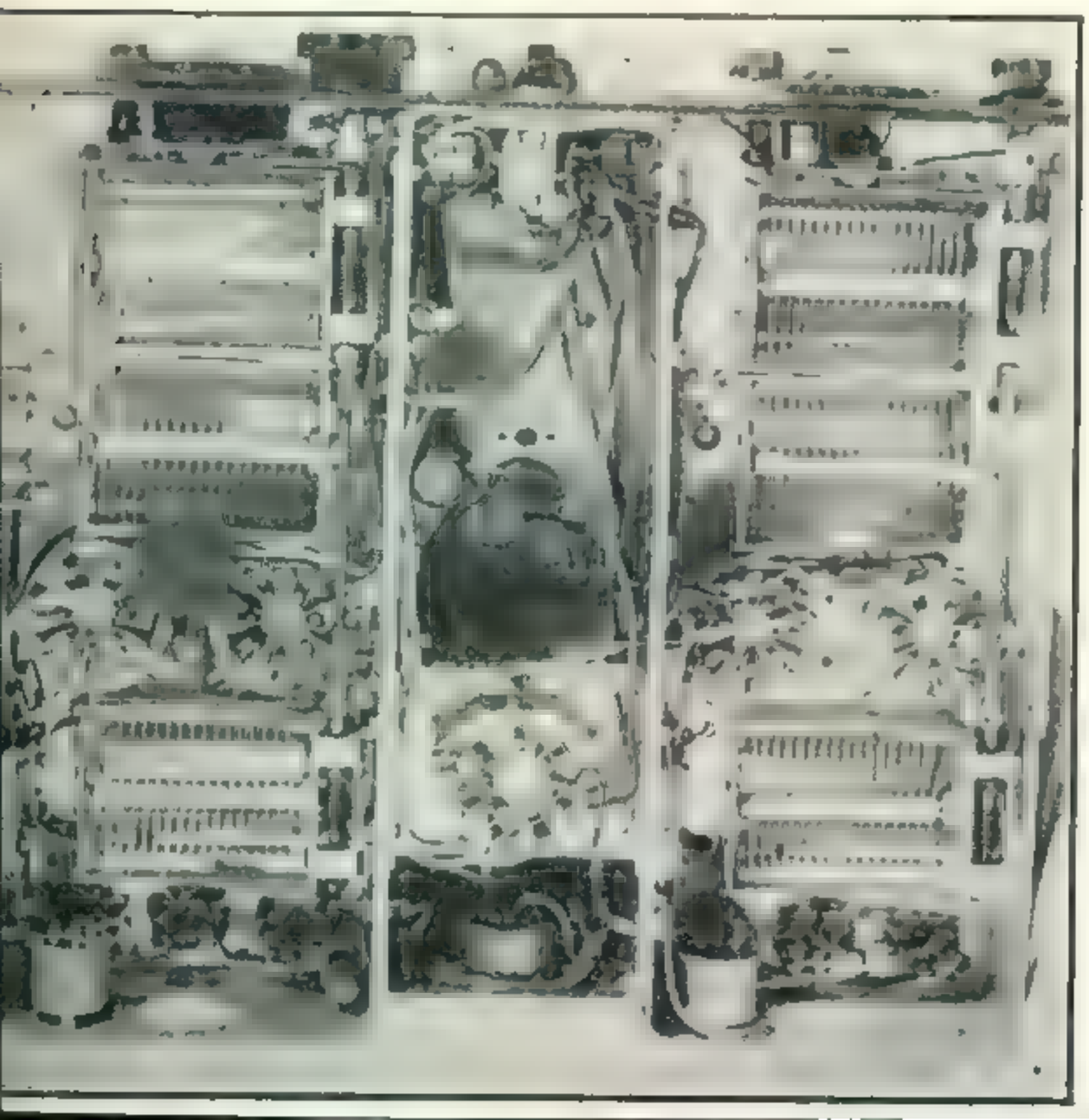
1. Remove *R71*.
2. Run lead on VT 138 *pin 7* to VT 138 *pin 2* and ground *pin 7*.
3. On one VT 136 *pin 7* is grounded, on the other VT 136 *pin 7* is ungrounded. Work with the ungrounded lead. Remove lead to VT 136 *pin 7* and run to *pin 1*. Ground *pin 7* (thus *pin 7* in both VT 136 tubes will be grounded and one side of the filament input circuit will go to ground).
4. Disconnect *K53* connection to plug terminal 5 and 6. Remove relay.
5. Disconnect *K54* and remove.
6. Remove *R70*.

The 390-ohm cathode resistor, *R77*, used with the 1629 should be replaced with a 1000-ohm ½-watt resistor. The cathodes of both of the 1625 tubes are then tied together and grounded through a SPST switch. This switch serves as a TUNE-TRANSMIT switch enabling the operator to open the cathode circuit of the final amplifier so that the oscillator may be zero-beat without undue interference. A power supply giving 12.6 v. a.c. (6.3 v. transformers in series are satisfactory) and d-c voltages from 500 to 750 at 200 ma and 150 to 250 v. at 50 ma is required.

In certain cases (ours included) it may be advisable to remove the loading coil in the antenna circuit completely. This coil will soak up quite a lot of the r-f that should be in the antenna. When using a coax line the center conductor may be tied into the rotary link in the final tank coil and the link used to load the antenna. The other side of the link is already grounded and it is only necessary to ground the outer braid of the coax line.[1]

* *220 Forest Glen Rd., Silver Spring, Md.*

1 See footnote 1 in WØZJB conversion.



Bottom view of SCR-274Ns showing units rack-mounted with switching circuits in between.

of the SCR-274N Transmitters

Mechanical Modifications

The mechanical arrangement of the ARC-5 did not harmonize with the rest of our rig and it was decided to rebuild into a relay rack. After some thought we evolved the arrangement shown in *Fig. 1.* The 3.0 to 4.0-mc transmitter is on the left and the 7.0 to 9.1-mc transmitter is on the right in the illustration. Above the two v-f-o control dials. The dials are combination indicator and panel lights. They may be adjusted to throw a beam of light in any direction along the panel. A single meter with meter switching is employed in conjunction with a 2-pole 11-position switch and the oscillator plate, final grid, final screen, or final plate currents may be read. Positions are also used to show the oscillator and final plate voltages. The details of this arrangement are not shown here since they may be quite easily worked out and will vary according to the number of meters the reader may have at hand.

The transmitter filament, oscillator plate, and final amplifier circuits are switched by means of the 3-position 3-pole switch in the lower center of the panel. The key jack is directly below this switch. The toggle switch to the right of the key jack is for SEND-RECEIVE and the toggle to the left is for TUNE-TRANSMIT. A pair of indicator lights in the upper center of the panel show which transmitter is in use. The pilot lights may be operated from the 12.6-v. filament supply by inserting a separate 47-ohm 1-watt resistor in series with each 150-ma pilot lamp.

To rebuild the ARC-5 into this arrangement it is first necessary to remove the front panel of the transmitters. Removing the front panel may prove to be the most difficult part of this operation. First remove the dust cover, all of the tubes, the calibration crystal and all of the knobs and dials. The antenna tuner will also come off as it is mounted to the front panel and chassis with 3–48 screws.

Aluminum rivets fasten the front panel to the chassis, but the heads of these rivets (three on each side and one on top center of the chassis) may be cut off with a cold chisel or drilled out. This permits removal of the front panel from the transmitter unit. The front panel of the relay rack may now be marked.

When two of the transmitter units are placed side by side there is sufficient space to mount a narrow chassis between the two and still put them in a standard rack mounting. We decided to place the VR-150 voltage regulator on this small chassis along with the dropping resistors, switches and cable connectors from the power supply. The dimensions of this chassis are 11½" x 3½" x 3". As a matter of fact, a doubler stage could also be built into this chassis if it is desired.

The three units are laid out side by side and bolted together to form one complete unit. The front panel is a regular 19" x 7" plate of black crackle 1/16" inch steel. The layout for drilling the panel requires a little extra care, although bushings should be used where possible to allow for a much greater tolerance. The meter, switch and screw holes may be laid out and drilled without difficulty. When the front panel is completed it is secured to the transmitter unit with two standard chassis end brackets and the various switch shafts and screws through the front panels. Two extra brackets in the center will add considerably to the rigidity of the completed unit.

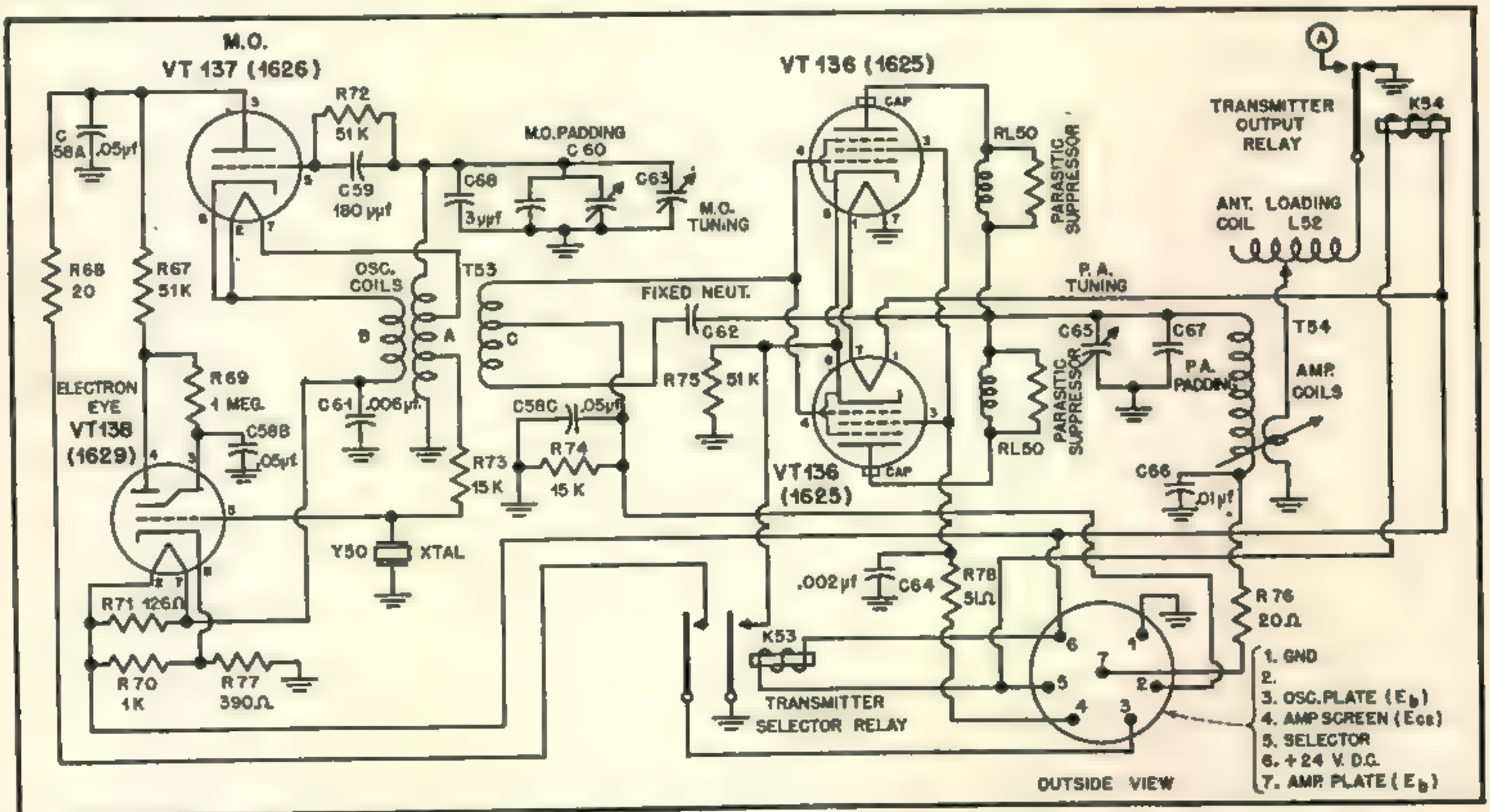


Diagram of the SCR-274N before any modifications have been made. All modifications described are based on this circuit.

We tried several different keying circuits and finally compromised on the simultaneous keying of the oscillator plate and the final screen voltages. This will allow break-in operation while keying the cathodes of the final amplifier will not. A keying relay is used which has been mounted on the rear of the small center chassis. The note sounds very good even though the oscillator is being keyed.

With a power input of about 100 watts we have found the performance of the ARC-5 excellent.

For 40 and 20 Meters

EDWIN W. HANNUM, W2VNU/8 †

By the simple expedient of switching the fixed air padder (across the PA coil) in and out of the circuit, efficient operation may be realized on both 20 and 40 meters. It is necessary to uncouple the PA tuning condenser from the drive and shaft mechanism and run its shaft out the side of the unit through a fixed or flexible coupling. This shaft is at ground potential. The oscillator tuning remains unchanged.

Only 20-meter operation was contemplated at W2VNU/8 so band switching was not incorporated. The "hot" end of the fixed air padder, *C67*, in the schematic was disconnected. There is, however, sufficient space along the side of the unit to mount a SPST switch for bandswitching.

For 11 and 10 Meters

VINCE DAWSON, WØZJB ††

AS MIGHT BE EXPECTED, our particular interest is a v.f.o. combination capable of working from 11 to 2 meters. The SCR-274N series, particularly the BC-458A and BC-459A, provide a ready answer to the problem. The former unit tunes initially from 5.3 to 7 mc, and the latter unit covers the range 7.0 to 9.1 mc. On 11 meters we use the 4th harmonic of 6.79 to 6.85 mc, on 10 meters we use the 4th harmonic of 7.0 to 7.42 mc, on 6 meters the v.f.o. is between 8.33 and 9.0 mc, while for 2-meter operation we use the 18th harmonic of 8.0 to 8.2 mc.

A first inspection will confirm that little conversion work is necessary to get these v-f-o units on the air. After a clean up with a few drops of light oil mixed with some carbontet applied with a stiff brush, the top shield is taken off by removing the small screws holding it in place. Then, if the unit is to be used strictly for v-f-o operation take the coiled spring lead that is actuated by the antenna change-over relay and solder it to the antenna feed-through post. Note at the same time that variable link coupling is used from the 1625 plates to the variable inductance. By rolling the inductance to "0" on the dial it is effectively removed from the antenna circuit, making a straight lead from the link to the antenna relay.[1] A coax cable is then used from the antenna post to transmitter. An adaptor for coupling the v.f.o. to a crystal stage is shown in *Fig. 1a*.

The filaments of the 274N are wired in series-parallel for a 24-28 d-c volt input. Since 807s require different sockets than 1625s and since there is no 6.3 volt equivalent to the 1626, it is suggested that a 24-volt output transformer be obtained that is capable of supplying about 2 amps. These are now becoming fairly common and should be available from most jobbers.[2]

The next step is to remove the bottom plate and locate relay *K53* which is mounted in the middle of the unit on the left side. This midget relay switches the plate voltage to the *VT137* (1626) and shorts out the biasing resistor *R75* (51,000 ohms). Either remove this relay entirely from the unit or tie it down in the energized position. If the relay is removed, the cathode wires from the 1625s should be grounded to the chassis and the red lead carrying the oscillator plate voltage from socket *pin 3* to *R68* is resoldered directly, in place of running through the relay arms.

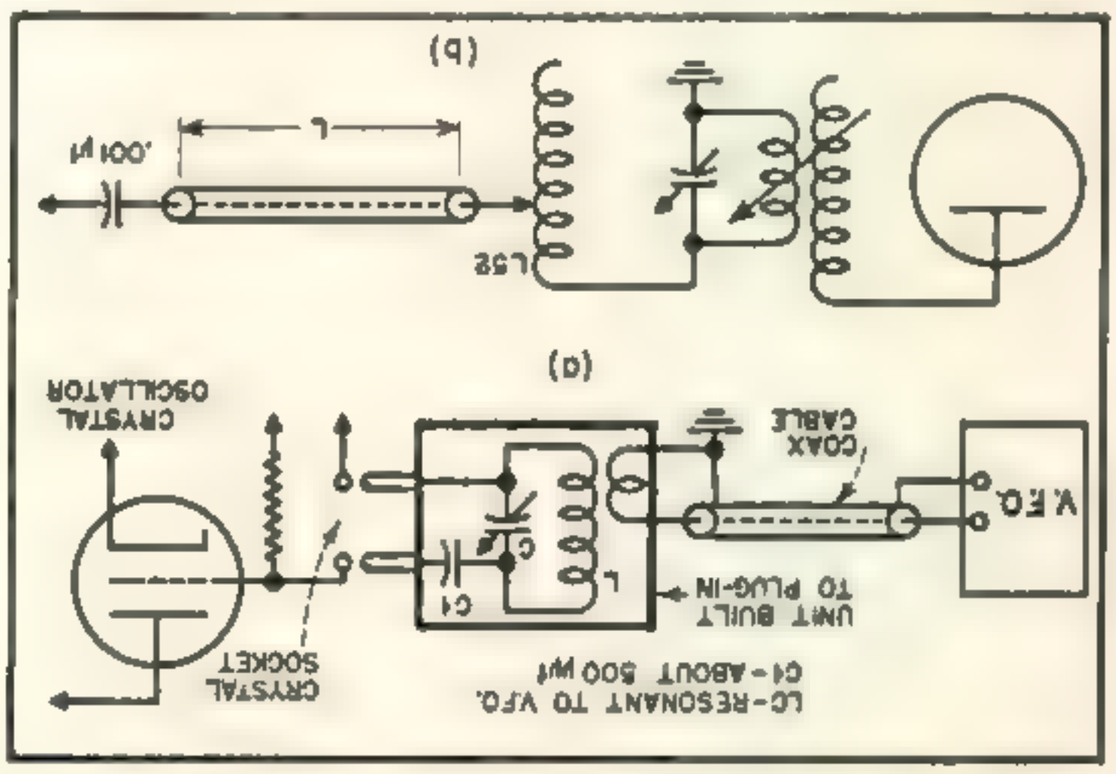


Fig. 1a. Adaptor for coupling v.f.o. to crystal stage
Fig. 1b. Alternate method for coupling to driver stage

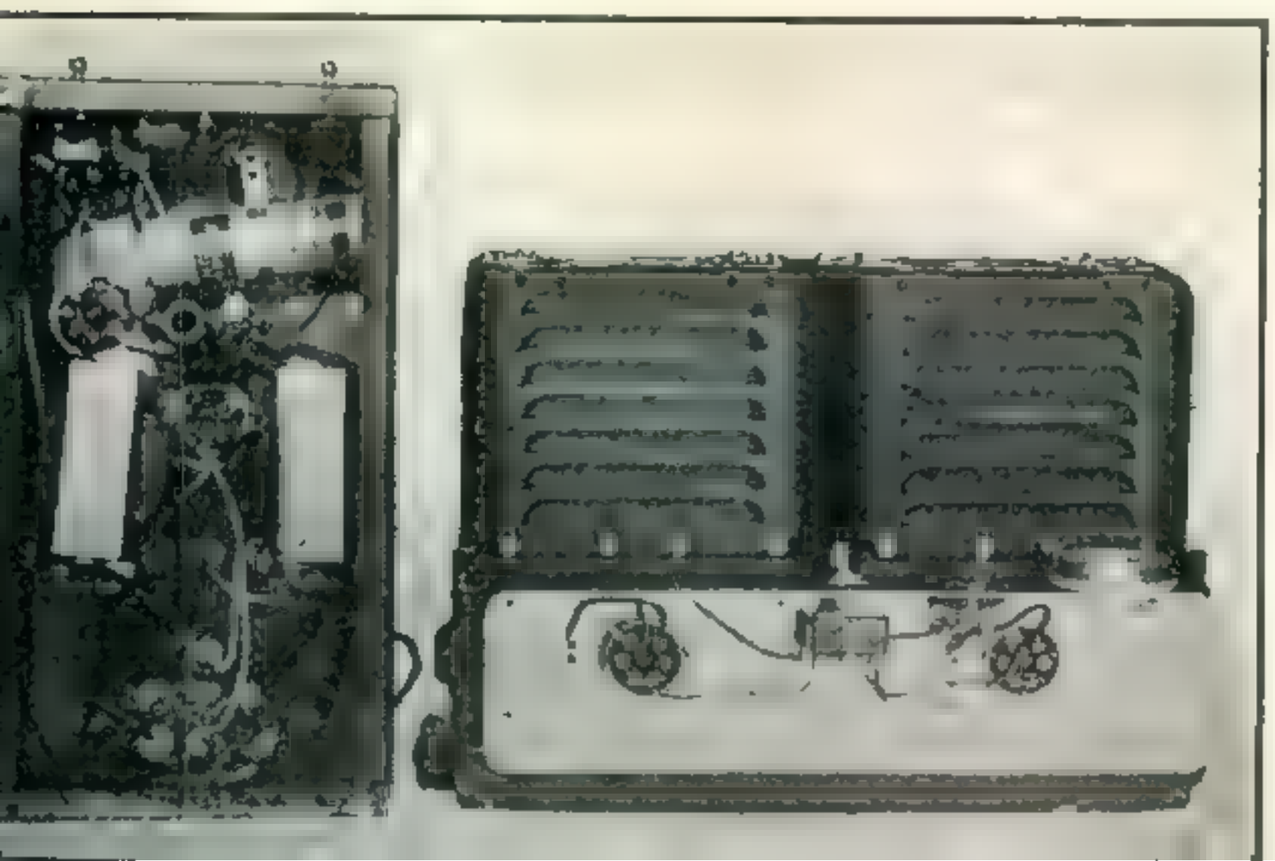
It is often worth while to use the magic-eye (1629) and crystal calibrator unit to check the v.f.o. in the absence of frequency standard. This unit normally would have used the 24-volt d-c filament voltage as the bias on the cathode of the 1629 through resistors *R77* and *R70*. To change this part of the circuit over to a-c operation disconnect the cathode lead of

(*Continued on page 87*)

† 44 James St., New Hyde Park, N. Y.
†† VHF Editor, *CQ*.

1 By choosing a reasonably small length of coaxial cable to connect to the transmitter the "antenna" coil of the 274N may be used as shown in *Fig. 1b*. The length of cable, L, multiplied by the capacity of the coax per foot (from the manufactures data this is usually equal to 20 to 30 μμf per foot) resonates with L52 and its associated link provided L is short compared with a quarter-wave at output frequency.

2 The 1625 sockets can be modified in accordance with instructions given on page 27, January 1948, *CQ*, in the article by W2CVV, "Mobile With the SCR-274N." For 12.6-v. operation the filaments should be wired as outlined by W3KHJ.



Rear view showing voltage-regulated power supply and method for switching power between the two units.

The YL's Frequency

Conducted by LOUISA DRESSER, W2OOH*

ONE LOOK AT THE photo opposite should cool your fevered brow on these hot summer days. It shows what Maude, VE6MP, and the other residents of Chancellor suffered last winter when Alberta was struck by continual blizzards that began the first of February.

Describing the hectic winter, Maude wrote: "When the snow plow got here (after two weeks) it took over two hours, with the help of thirty men with shovels, to break through the drift you see in front of our house. It was 10 o'clock at night, and I made coffee and sandwiches for fifteen of the men!

"For almost two weeks we were completely isolated here—no mail (which comes in by car three times a week), no telephone, no train, and the only means of communication was through our station. For three days our power was off, but Ellen, VE6KU, on a ranch fifteen miles from here, has her own power, and she got in touch with a ham in Alberta who phoned the power company. The company had to hire a couple of planes to bring men out to repair the lines, and they were not sure whether or not Chancellor was fixed up until they got back to headquarters and heard me on—hi!

"The morning after we had power again one of our folks here had a sudden attack of acute appendicitis and his son came rushing to the house for help. VE6UY in Calgary, 65 miles away, answered our emergency call, and a plane came out in less than an hour. We arranged for an ambulance to pick up the patient at the airport. The doctor said it was just in the nick of time, as gangrene had already set in.

"Then an old lady here ran out of insulin. It was on a Sunday, and Win, VE6OD's XYL, tramped all over Calgary, even to the hospitals, and finally routed out a wholesale drug manager before she located the required amount, which then was flown out to Chancellor.

"For ten days we were continually on the 75-meter band getting messages back and forth. We did all our work through VE6OD in Calgary. When he went to the office his XYL took over and listened in every hour. If we needed any help between times, all I had to do was to call V6EOD and some SWL in Calgary would ring Win on the phone and tell her I was calling. Win really was a brick, and I bet she delivered a hundred messages for us over her phone. She even made personal calls at the hospitals in order to let us know the condition of various patients.

"Also, many people had gone to Calgary before the blizzard and couldn't get home. (Eventually they had to fly back.) Then part of the family would be on their farms, and with no mail or telephone the family would be worried. Some days I'd have my house full of people talking to their folks at VE6OD."

The QTH of Maude Phillips, VE6MP, and her OM, VE6HZ. The pretty white stuff is a drift which in the middle of April still stood 20 feet high. The 75-meter halfwave doublet was used on all bands most of the winter because the many high snowbanks around the house brought their signals on the beam down a couple of Rs!

Maude closes with the comment: "Ham radio is really wonderful, isn't it?" Certainly she has done much to add to the good name of ham radio in general and the YLs in particular.

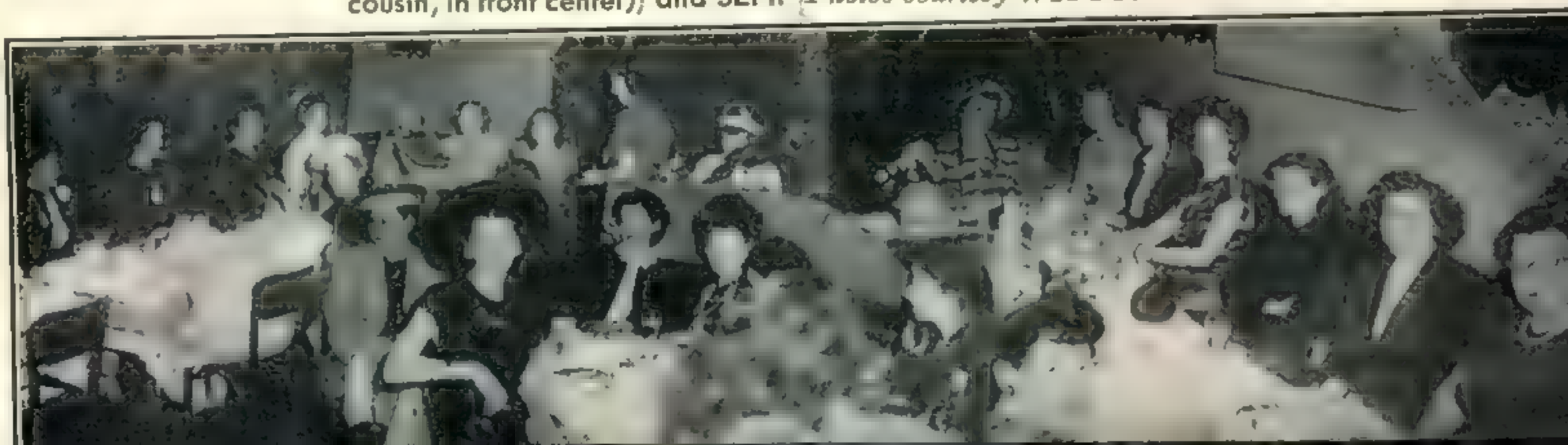
Conventions

More ham conventions coming up! For the benefit of vacation-minded YLs, we're calling these events to your attention early. Among them are the National Convention to be held at Milwaukee, Wis., September 4 through 6 (Labor Day week-end), and

(Continued on page 82)

** Assistant Editor, CQ. Send all contributions c/o CQ, 342 Madison Ave., New York 17, N. Y.*

YLs of the N.Y.C. Club sample luli kebab, blinchiki, and other Russian delicacies at their Spring luncheon. *From left to right, back row:* XYL of W2MWK; W2RAQ; MEG; TU, vice president of the club; PMA, secretary; NFR, president; RTZ; QGK (standing); TBU (behind QGK); QWL; PZA; NFR (again—not twins!); NGO; OOH; an SWL; PUY; Helen Zuparn, treasurer. *Second row:* QGK's cousin; Mae Gallup; TWJ; BBV's XYL, and her mother; and JZX. (*Inset, front center:* SYE; TTO; RLG's mother; an SWL; OWL (behind QGK's cousin, in front center); and SEH. *Photos courtesy W2TTO.*



Monthly DX Predictions-July

OLIVER PERRY FERRELL*

SEVERAL INTERESTING developments were brought up at the Washington propagation meeting in May. One of them is the partial confirmation of the Pedersen Ray and the part it plays in h-f communications. This writer feels that after hearing it thoroughly discussed by Robert A. Helliwell, W6MQG, of Stanford University, that the Pedersen Ray might easily explain many instances of amateur 10 and 20-meter communication at somewhat higher angles of radiation than necessary or required by the lower ray. A promise has been extracted from W6MQG to expound on this theory and it is hoped that an article will soon be ready for print.

Each month four graphs are presented which may be taken as representative of the general conditions to be expected during the month. In each graph the MUF (maximum usable frequency) is the variable function indicated by the single line. The LUHF (lowest usable high frequency) is the remaining function that encompasses a shaded area representing all the unusable frequencies. The LUHF is calculated on the basis of 1000 watts of effective radiated power using c-w signals. The LUHF is so computed that for extremely weak signals it may be a trifle higher than observed. For phone signals the LUHF should be from one to two megacycles higher at the given time.

Graph 1 illustrates the predicted median conditions over the path from western W4, northern W5, W9 and WØ call areas to South Africa. Absorption is quite high during July in the northern hemisphere and only two weak openings can be predicted. The first will probably last about one hour starting around 0045 CST. The second extends from 1515 until 1915 hours CST. 40 meters will be unusable due to the atmosphere noise level.

Graph 2 shows the predicted median conditions for the path from the W6 and lower W7 call areas to Japan and Korea. No great variations in the MUF are expected and the peak value of 24.5 mc is only seven megacycles above the median minimum value for the entire month. Atmospheric noise which is not accounted for in these graphs probably will prohibit the use of the 40-meter band. The 20-meter band should be usable over this path from about 2020 PST until 0945 PST the following day. Atmospheric noise may also become a problem at this frequency since directional antennas from the United States must be aimed at the noise sources around the Bay of Bengal that lie on the same azimuth. Also, the proximity of the western end of this path to the noise sources will make many signals from the States unreadable. Probably the best time for working this path will be around sunrise at the eastern (W6) end. No 10-meter band opening is predicted. However, it is interesting to note the apparent usefulness of the 14-meter band which opens around 1115 PST and closes about 0030 PST. Absorption and atmospheric noise would not be a great problem at this frequency.

Graph 3 depicts the median conditions from the W1, W2 and W3 call areas to Argentina, Uruguay and central Chile. Only a minor 10-meter opening can be forecast with the MUF just barely getting to the center of the band between 1230 and 1500 hours EST. Some revision in the MUF may be made after 1500 hours on good days when the band is likely to stay open with increasing signal strengths until 1800 hours EST. Absorption is still quite strong at 20 meters during this month and two fair openings are predicted; one starting at about 0530 hours and lasting until 0745 hours EST, another beginning after 1715 and possibly running through the night until 0330 hours the following morning. Strong atmospherics should prohibit the use of 40 meters and may at times be bad enough to limit the readability of 20-meter signals.

Graph 4 shows the conditions predicted over the path from W8, W9 and WØ areas to New Zealand. Characteristically poor conditions for July are shown with the only opening on any band of any promise at 20 meters from 2100 to 0230 hours CST the following day. Probably the latter half of the predicted opening will be more usable with emphasis on conditions after 0100 hours. Little can be expected from 40 meters at this season and no 10-meter band openings are predicted. Similar conditions are predicted for the path from the central United States to Australia. Displacing both curves in this graph about one hour later will give an approximate idea of what to expect during July.

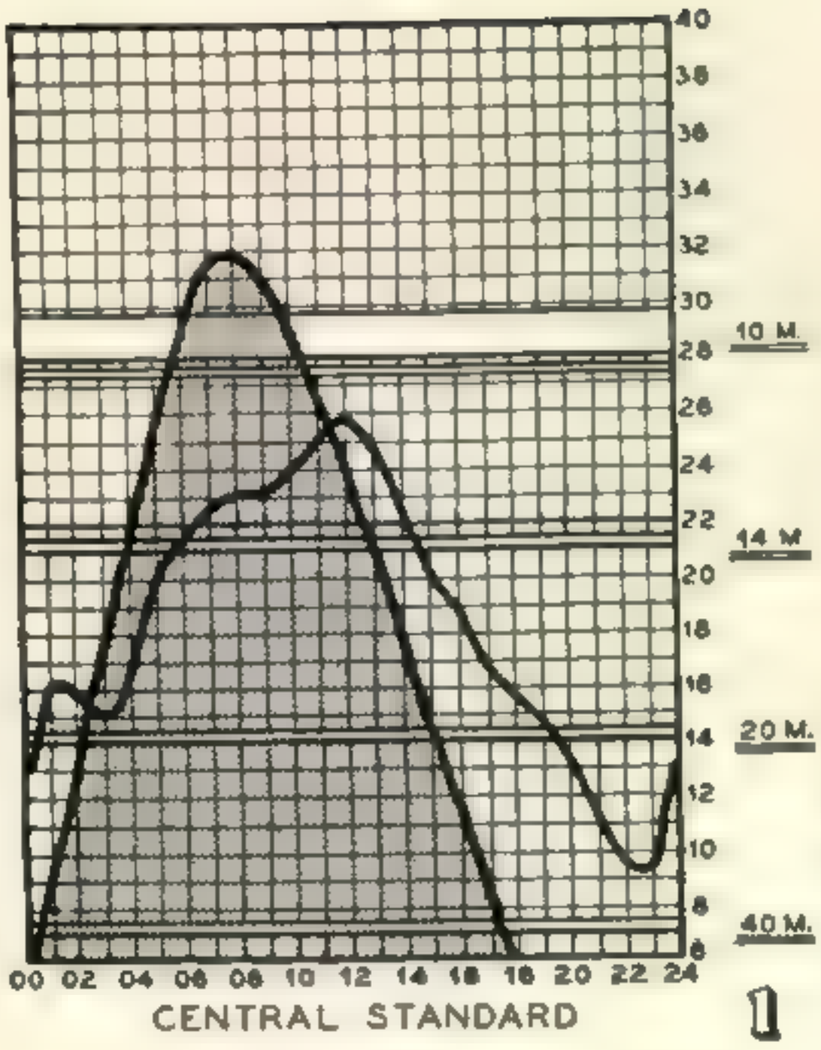
Ionosphere Storms

The prediction of ionosphere storminess has progressed very favorably based solely upon the activity of known solar cycles. Both cycles predicted for the month of May reappeared with some aurora noted on the storm of May 22–23. This cycle proves rather interesting as it has been running for five solar rotations. In July it is likely to flare up again and may cause abnormal conditions during the period from July 14 to 17. A new storm cycle appeared in May and should it, too, survive several solar rotations it may cause some storminess from July 8 to 10. As the month opens the conditions may be disturbed from the storm forecast June 30 to July 3. Sporadic-E activity of long duration and very high MUF should follow the pattern July 2 to 6, 9 to 12 and 16 to 21.

The data for the preparation of the MUF curves is derived from the booklets issued by the CRPL of the National Bureau of Standards entitled "Basic Radio Predictions Three Months in Advance." These are available on a subscription basis from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

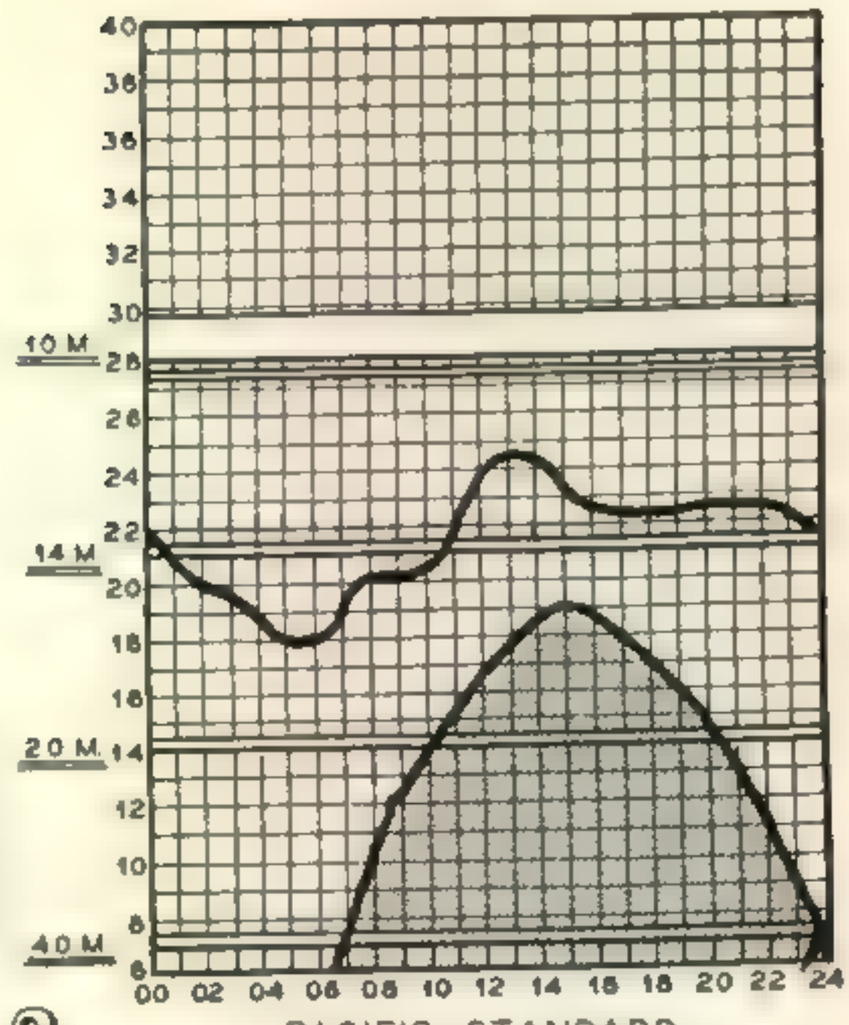
*Assistant Editor, CQ.

Monthly DX Predictions



1

Maximum Usable Radio Frequencies—Charts show the maximum usable frequencies propagated by the F2-layer over the paths indicated in the world map. The abscissa shows the local standard time at the point of origin of the path. The ordinate shows the frequency in megacycles. Amateur frequencies fall within the two heavy parallel lines that indicate the upper and lower limits of the principal bands.



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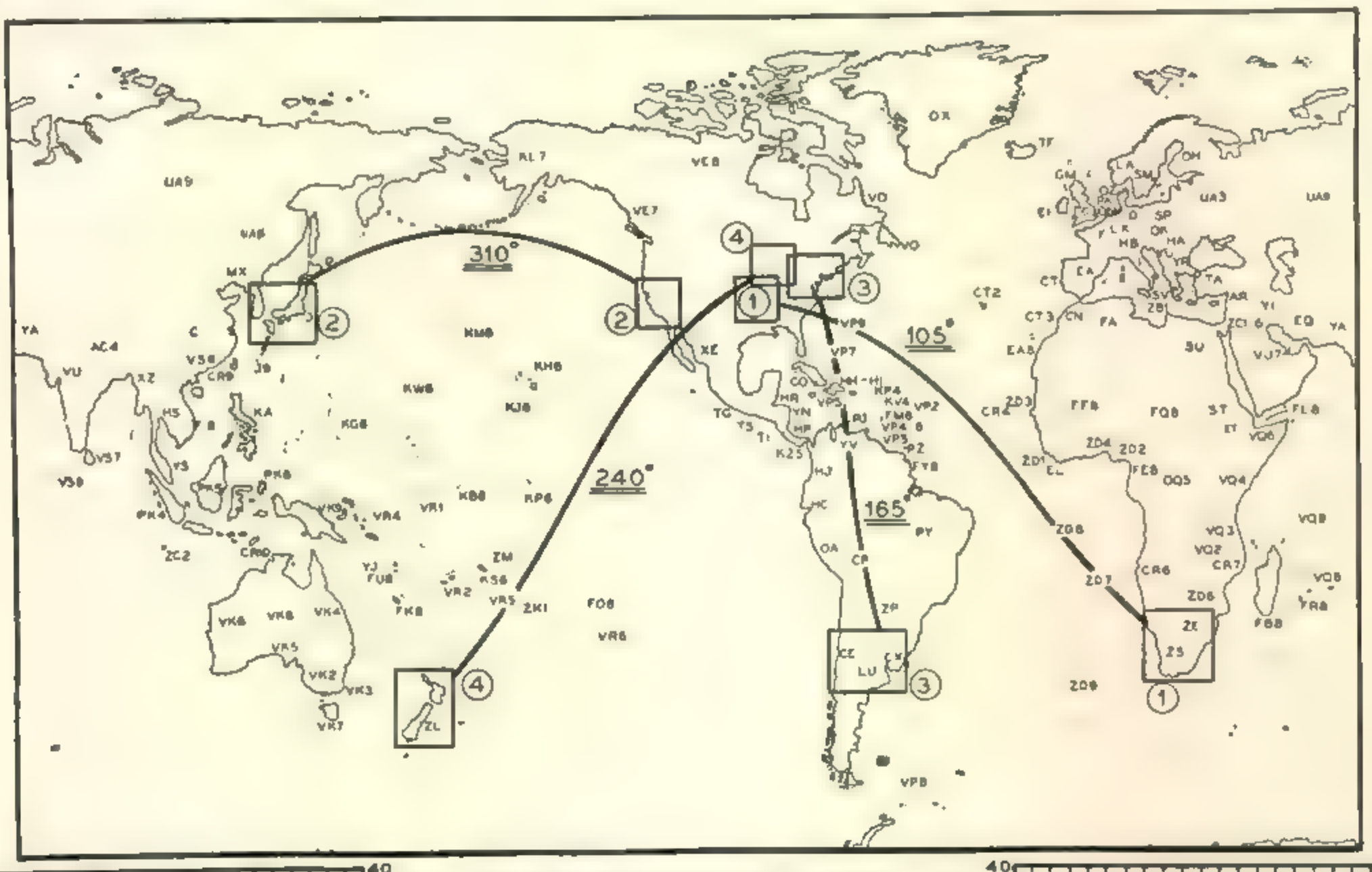
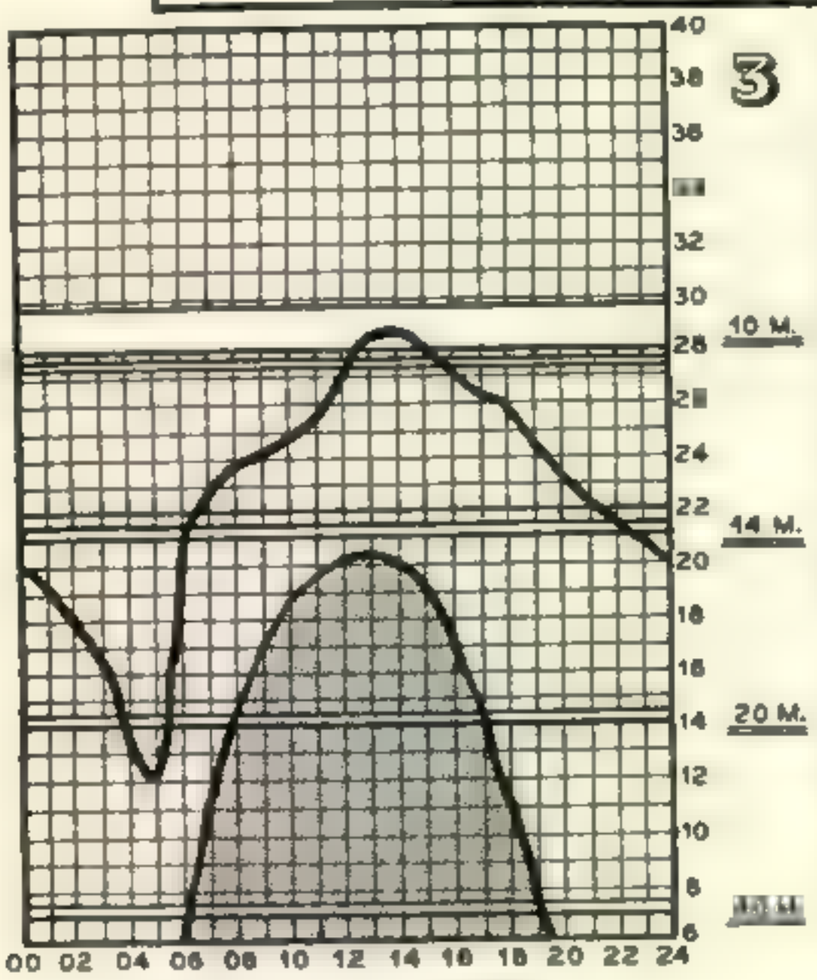


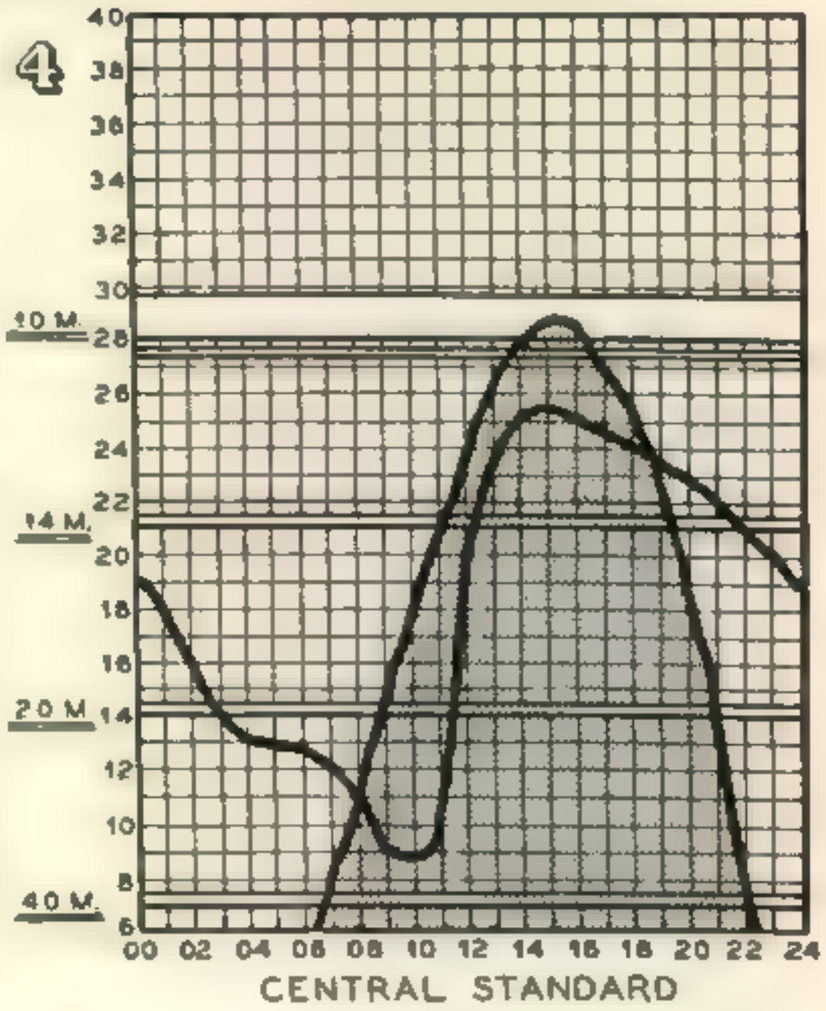


3

Lowest Usable Radio Frequencies—The shaded area in each chart indicates unusable radio frequencies for the illustrated path. The LUF is calculated for an above average amateur location using a good communications receiver. The effective radiated power is assumed to be 1000 watts. The LUF is based upon average monthly signal absorption and does not include the effects of abnormal or auroral zone absorption.

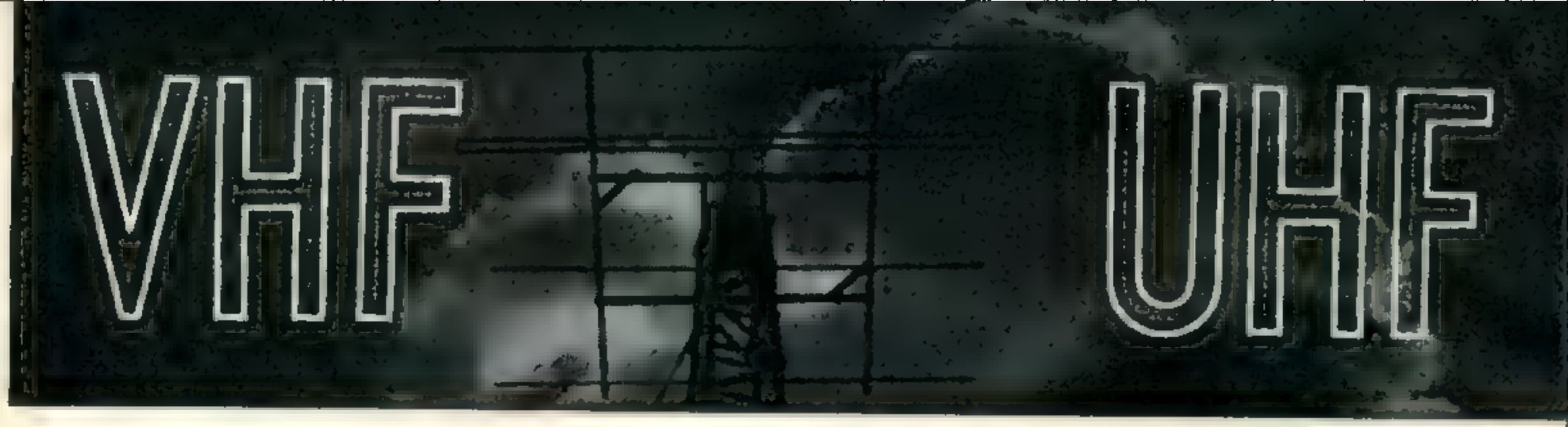
Azimuth—Radio transmission is known to vary considerably with geographic latitude and longitude. Each path MUF and LUF as illustrated is calculated for the "short-path". This is the path shown in the map.

Variations in Forecast—All graphs are monthly predicted average conditions. On ionospherically "quiet" days some variation amounting to less than 15% may be expected. However, a value representing 0.85 of the MUF will be exceeded over 90% of the total time. The graphs do not indicate radio propagation conditions during ionosphere storms or sudden ionosphere disturbances. They are not adjusted for the effects of sporadic-E layer formation or long and short scatter. Radio disturbances of the ionosphere storm type are the most severe for paths which pass through the auroral or polar regions, the effects gradually tapering off towards the equator.



4

VHF UHF



Conducted by VINCE DAWSON, JR., WØZJB*

THE MONTH OF MAY can easily be the turning point in v-h-f experimentation. Formed during this period was a cooperative 6-meter radio amateur observing program. The program will be the first concerted effort to study sporadic-E layer transmissions above 30 mc. Analyzing the observations and reports will be the Geophysical Research Division of the Watson Laboratories under contract to the Air Materiel Command (USAF).

The reporting form system inaugurated by this Department over one year ago will be greatly expanded and will serve as the medium for collecting 6-meter observations. Credit for the formation of the observing program is due to our propagation-minded assistant editor, Perry Ferrell, whose original studies using amateur v-h-f data is creating considerable favorable comment for the 6-meter men. First subject in order of study for the 6-meter program will be the sporadic-E drift phenomenon reported in our column last month.

It is especially gratifying to your conductor that we have been able to show those faithful 6-meter reporters some conclusive evidence of their past cooperation. At this writing there are a great number of details to be ironed out, however, all of our regular reporters and contributors are being notified directly from the Watson Laboratories. Pressure of making the arrangements has prohibited Ferrell from preparing the article on how the 6-meter data is analyzed, but it should appear in the near future. Progress reports on this observing program will be incorporated as a part of this monthly column.

The Bands Come to Life

By leaps and bounds the v-h-f bands suddenly came to life during the last part of April and are still going strong as this is being written.

The 6-meter band which had showed little or no promise since January 4 got off to a very good start, although hampered by repeated ionospheric disturbances even to the week-end of May 22-23. Everyone has noticed the increased activity with plenty of new calls on the air. The old-timers seem to be enjoying it best as they renew their seasonal acquaintances.

Not to be outdone by their bigger and older brothers (figuratively speaking), the 2-meter boys are plugging the band for all it is worth in preparation for a strenuous Summer and Fall. Jerry Grant, VE1QY, in Yarmouth, N.S., started the 2-meter band off right by working ten W2s and a couple of W1s on April 19. Jerry says that the W2s were the stronger of the two groups, which seems to indicate that one of those "leaky" ducts described elsewhere in this issue was present. While the duct-widths drawn are for ground-based elements with the fifth root profile, it does not rule out the possibility of an elevated duct that passed over the Boston area.

The Texas lads with their eye on that "Yankee" 2-meter record have been doing some excellent work with what seems to be comparatively rather simple antennas and rigs. W5AJG in Dallas started looking for the south Texans during the early morning hours and on April 28 was rewarded with two 375-mile contacts, when W5DAA and W5JKB in Kingsville came through. The surprising part of it is that it caught on very rapidly and W5AJG has worked all the southern Texas stations within 300-400 miles that are on 2 meters. The rig at W5AJG is 40 watts to an SCR-522 with a folded dipole antenna—very very far from the elaborate East Coast standards.

W5SM, in Beaumont, Texas, has also been in on this early morning activity and has worked up to within 30 miles of the Louisiana-Texas border. All the Texans are looking for stations to get on in either Louisiana or Oklahoma. Anyone interested can write to either W5AJG or W5SM and skeds will be arranged.

A short note advises us that W2TDW operating portable W4 outside of Knoxville, Tenn., worked W2RH in Port Chester, N. Y., on May 9 from 2013 to 2026 EST. Bob, W2TDW/4, was operating 144 mc from Clingmans Dome in the Smoky Mountains making the distance approximately 640 miles.

The South American paths were still very active during the month of April with XE1KE working into Buenos Aires on April 1, 2, 3, 5, 7, 8, 9, 12, 13, 14, 17, 18, 19, 20, 21, 23, 24, and 25. PY2QK, PY2AC, TG9JW, CE1AH, OA4BG, CX3AA, OA4AE, XE1GE, XE1QE, ZE1FU and XE1KE were all worked from Buenos Aires during the month. W5VY was heard on the 20th of April at 2159 EST. Some rebound scattering has been reported and LU5CK says that CX3AA (about 130 miles away) has been heard and worked with both Montevideo and Buenos Aires stations pointing their antennas northward.

B.J., at XE1KE, worked during the month of April: LU5BO, 9MA, 6DO, 9EV, 5ET, 8DJI, 1DO,

Send all contributions to Vince Dawson, Box 827, Gashland, Mo.

Miles Newton, W4EID, and his mascot Susie.

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50-MC DX HONOR ROLL

Calls	States	Others
W6UXN	46	VE1, 2, 3, 6, 7-KH6
W4GJO	45	VE1, 2, 3-OA4
WØZJB	45	VE2, 3, 4, 7-G5
WØUSI	45	VE2, 3, 7
W6WNN	45	VE1, 7
W9DWU	45	
W9ZHL	45	VE1, 2, 3, 4, 7-XE1-KL-G5-HB-8G6, 5-KL7
W1CLS	44	VE1, 3, 7G5, 6-F8-PAØ
W7BQX	44	VE1,3,4,7
W7ERA	44	VE1, 7
W7FFE	44	VE1, 7
WØDZM	43	VE1,2,3,7
WØQIN	43	VE1,2,3,7
W9PK	43	VE1, 2, 3, 4-XE1
W9ZHB	42	VE3, 4, 7-G5-HB8-KL7
WØBJV	42	VE2, 3, 7
W3CIR/1	41	VE1
WØINI	41	VE2, 3, 4
W5VY	40	VE3, 4, 7-KH6-LU9-XE1-OA4-PAØ-G2, 5, 6,-F8-HB8, 9
W8ZVY	40	VE1, 2, 3-OA4-LU9-KL7-PAØ, G2, 5, 6
W4QN	40	VE2, 3-OA4
W1LLL	40	VE1-G5-G6-PAØ
W8NSS	40	VE1,4-VP7
WØSV	40	10 VE7
W4GIY	40	VE1
W4EQM	39	VE1, 2, 3, 7-XE1-KL7
WØYSJ	39	VE2, 3, 7
W6ANN	39	VE1,7-KH6
W7HEA	39	VE1-7
W8QYD	39	VE1,2,3,4OA4-G5
WØDKS	39	VE3, 4-XE1
W5JLY	38	VE3, 7-XE7-O-A4-G5, 6-PAØ HB8
W4EID	38	VE1,2,3,7-OA4, LU7
W2AMJ	38	VE1, 3, 7-G2, 4, 5, 6F8-PAØ-HB8
W5AJG	38	VE2, 3-KL7-G5, 6-HB8-PAØ
W5FRD	38	VE3,7-XE1-PAØ
W5ML	38	VE3-XE1
W8ZVY	38	KL7-G5
W6OVK	37	VE1, 2, 3, 7-KH6
W2RLV	37	VE1, 3, 7KL7-G2, 5, 6-PAØ
W2IDZ	37	VE1, 7-G5-G6-PAØ-F8
W6OYK	37	VE1,2,3,7-KH6
W5JTI	37	VE3-KL7-XE1-OA4
W7DYD	37	VE1, 7
W9UNS	37	
W5VV	36	VE7-XE1
W7FDJ	36	VE1, 7
W5FSC	35	VE1, 3, 7-XE1-OA-KL7
W1GJZ	35	G5, 6-HB8-PAØ
W3OR	35	VE1, 7-G-PAØ-KL7
W5HF	35	VE1,3,4,7
W5HTZ	35	XE1-VE2, 3, 4
W1JLK	35	VE7-G5
W9ALU	34	VE1,2,3,4-KL7-G5
W2BYM	34	VE1-VP7
WØDKS	34	VE3
WØJHS	34	VE1-2
W7JPA	34	
W4WMI/4	33	VE1, 2, 3-VP7
W1HDQ	33	VE1-G5-G6-PAØ
W6BPT	33	VE1, 2, 3,7-KH6
W4DRZ	33	VE1, 2, 3,
W6PUZ	33	VE3-7
W7KAD	33	VE7
W3MKL	33	VE1, 7-G5
W9ALU	33	VE1, 2, 3, 4-G5-KL7
W1CLH	32	VE7-G5-G6
W3RUE	32	VE1-G2, 5, 6
W6FPV	31	VE1, 2, 3-KH6
W4FBH	31	VE1, 2, 3-XE1
W5LCZ	31	VE3-XE1
W3OMY	31	VE1-VP7
W5WX	31	VE4-XE1
W4HVV	30	VE1, 2, 3
W9UIA	30	VE1, 2, 3
W5ELL	29	VE7-XE1
VE1QY	28	G5, 6-VE1, 3, 7
W4EQR	28	
W1CGY	28	VE1-G5-G6-PAØ
W4FQL	28	VE1
W1ATP	28	VE1, 7-G5
W9FKI	28	VE1, 2, 3-KL7
W5ESZ	28	VE7
W1AF	27	G-F8-PAØ-VE7
W7ACD	27	
W5LBG	26	VE7-XE1
WØDNW	26	
WØYKX	26	VE2, 3
W7BOC	26	VE1
W6NAW	25	VE7
W4FNR	25	VE3-OA4-LU7
VE1QZ	24	VE1, 2, 3, 7-G2, 3, 5, 6-F8-HB8-PAØ
W7JPA	24	VE7
W5LIU	24	VE3-XE7
G5BY	23	W1, 2, 3, 4, 5, 8, 9, Ø-VE1, 2, 3-MD5-SU1-ZS1
W8MVG	23	G5, 6-PAØ-F8
W9AB	23	VE1,2,3,4
W7CTY	22	VE7
W8YLS	22	VE2
W4JML	20	VE2-3-G5
XE1KE	13	XE-W4, 5, 6, 7, 8, 9, Ø-LU-CX-OA
KH6PP		KH6-W5, 6, 7-KW6-VK5-LU1, 3, 4, 5, 6, 9-CX3
W4GJO		XE1-KL7-VE7-LU7
W7BQX		VE1, 2, 3, 4, 7

3BD, 1AM, 6DR, 8BQ, 3EL, 5DO, 2BG, 9AX, 5CK, 4CD and CX3AA. OA4AE was worked when Buz was visiting at LU6DO.

Conjecture follows conjecture as to what is the exact cause of these repeated post-sunset openings. Ferrell had the opportunity to discuss them at the CRPL meeting in May, but no definite suggestions were forthcoming, neither do ionospheric records from Huancayo, Peru, give any help. Fortunately, the stations in on these paths have been cooperating with this column nearly 100 per cent and an attempt is being made to analyze the data on a seasonal basis. The number of openings is dropping off rapidly and, should the postulated seasonal variation be a true one, there will probably be no openings after May 20 or 25.

Horizontal/Vertical Question?

We were very surprised to find a notice from the Amateur V-H-F Institute of New York announcing that their members would whenever possible use vertical polarization on the v-h-f bands. It was not so much the announcement itself that startled us but the reason behind it. The general tone of the notification seemed to stress the fact that the horizontal-vs-vertical polarization question still existed. If the adherents to both sides of the question would but stop and look at the subject objectively they would find that there is not, never was, and probably never shall be any great room for argument.

To discuss the relative merits of horizontal-vs-vertical polarization is just recovering old and well-worn ground. A specific polarization works well with one type of location, the opposite polarization at a second location. Comparing the two, as if they were on equal terms, is impossible, and has accomplished little, only to retard our v-h-f progress.

During the war the Propagation Group from Columbia University, as well as many others here and abroad, found it necessary to examine this very question. They did study it, and their projects were carried on over a period of several years.

(*Continued on page 74*)

DX AND OVERSEAS NEWS

Conducted by HERB BECKER, W6QD*

LAST MONTH I told you I didn't know whether or not there would be a DX column in the July issue, due to my being in and around Chicago at the time I would normally be working on it. Of course, I should have let it lie there. But, no, it just wasn't to be. Larry "Boss" LeKashman, W2IOP, met me at the Stevens Hotel in Chicago for a huddle. Says I to LeKashman, "Don't think we'll have a column this month, Larry." Says he to me, "Well, that's fine . . . we'll give the boys a rest and put something *important* in the space." This was not the answer I expected. Our huddle could have ended right there . . . and probably should have. Instead, however, I opened my big mouth again and said," Larry, on the other hand I don't think we should give our DX gang a rest. They have been seeing (if not reading) this stuff for some time now and if we break the pace they might get soft and switch to 2 meters and Dawson's column . . . or even go so far as to read your Editorials." This would never do. Frankly, you ought to read some of his Editorials . . . but not *first*. (Boy, if he doesn't chop this out I can say anything.) Anyway, a thought struck me . . . yep, just one . . . and I told Larry, that for years, I have seen these big-shot columnists have a "guest columnist" do their stuff once in a while. Why shouldn't I have a guest columnist? Of course, by now you know darn well you're stuck with the DX column this month again. I have asked my good friend Andy Elsner, W6ENV, to dig the DX material out of my file in Los Angeles and compose the DX happenings of the past month.

Following is the complete DX report written to me on the letterhead of Andy Elsner, W6ENV. I liked reading it and I know you will.

Los Angeles, Calif.

Herb Becker, W6QD/W9
Chicago, Illinois
Dear Herb:

Wow! You sure picked a swell time to duck out and leave us here holding the bag. You should see the cards that have been rolling in since you left. Betty (your secy., not Grable) has moved out into the hall to make more room, and we're planning to sell the office furniture for firewood. Actually, we have only twelve new W.A.Z. claimants to announce this time, but the grapevine rumors tell us that this is but a small sample of what's to come. To think one guy with one transmitter and an NC-100A could do this to us. Is it true that Larry is now ordering W.A.Z. certificates in lots of 10,000? How about a super award to the one boy that has been on at least once this year, and has not worked *C8YR?*

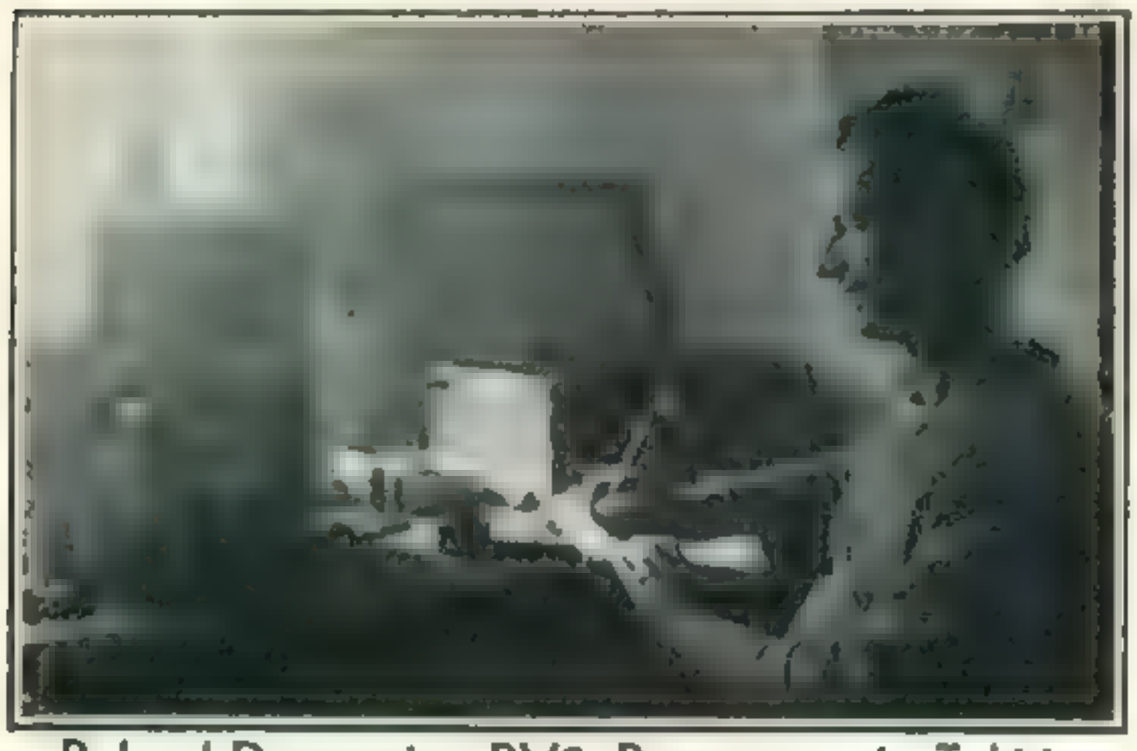
Congratulations on achieving W.A.Z. are now in order for these patient and long suffering DX men: Art Bean, W7AMX, No. 28; Frank Pratt, W7DXZ, No. 29; Jerry Fries, W6PCS, No. 30; Bob Hoffman, W7DL, No. 31; G. R. McKercher, W6MLY, No. 32; Shelley Trotter, W6BAM, No. 33; Wendell Peirce, W6FSJ, No. 34; Clay Murdock, W6OMC, No. 35; Norm Wasson, W6NNV, No. 36; Bill Adams, W6ANN, No. 37; Ken Olson, WØYXO, No. 38; and Vince Davis WØNTA, No. 39. The cards from the last two made a duet from the Zero Quartet. They arrived under separate cover, but simultaneously. The Honor of being the first WØ W.A.Z. went to YXO because he made the contact first. These boys really stick together like a flock of W6s. While on this W.A.Z. subject, Mark Graffis, W6PFD, seems to have taken things into his own hands to start us to thinking about a super-super deal. He has just recently worked W.A.Z. in only 6 days and 12 hours! I'm now looking for a place to hang up my key. Seems like this should deserve some kind of reward. Herb, could you spare a 35T out of your final for Mark?

Some awfully choice stuff has been appearing recently. *ZD9AA* finally got going with a 5-watt job that can really be heard. *ZD2RGY* is a new one in Nigeria. We hear that *AC4YN* is active again, both phone and c.w. *VR2AZ/VR1* in Canton, British Phoenix Is., seems to be on phone now more than c.w. *C8LS* in Ningsia, Inner Mongolia (*Zone 23*), has been well worked over by the West Coast gang. *ZC1CL*, ex-MD1D and ex-LI2CL, Danny Lockyer, is now on, if he doesn't get closed down with the war over there. And last, but not least, we hear *AC3NC* in Gangtok, Sikkim, working a few. Conditions are supposed to be poor, but it "dern't" sound like it.

From *EA9AI*, via XE1AC, we hear that *EA8EDZ* in Rio de Oro is now QRT, but will soon return and probably with an EA10 call. Yum, yum. W2MRE has received a QSL from *PX1A* in Andorra, who says, "I am the sole ham in Andora.Other PXs you may hear are pirates." Isn't that awful? Also W9WCE says he has good reason to believe that *PX1B* is in Cologne, Germany, and not Andora. It kinda looks like the fun-loving boys who used to sign LX so brazenly have changed a dot to a dash. W6YYW,

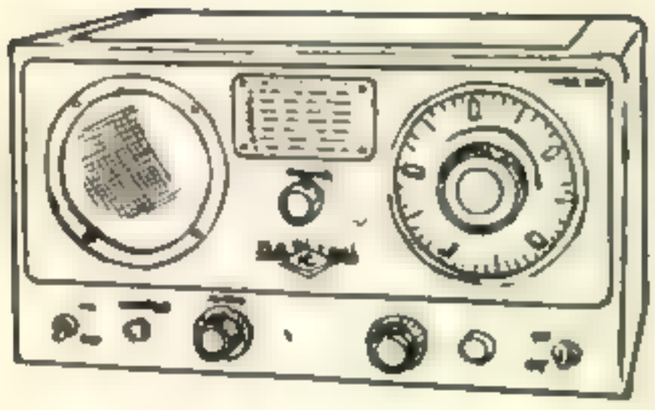
(*Continued on page 62*)

**Send all Contributions to Herb Becker, 1406 South Grand Ave., Los Angeles 15, Calif.*



Roland Dassegnies, RV2, Raevavae, via Tahiti.

(Number ten of a series)



Recently the three volume summary technical report of the Committee on Propagation, National Defense Research Committee became available. The report is a summation of war-time research into tropospheric propagation. It also brings the subject up-to-date and presents some extremely useful data on v-h-f and u-h-f radio transmission. What today is known about super-refraction and its effect on communication at these frequencies is recapitulated. However, the thing that particularly interested us was not what was known, but rather what was not known about tropospheric propagation, and where further research was considered necessary.

This seemed to be related to something that is being heard more frequently in these days. That is, in the great expansion of electronic equipment, the factor of quantitative performance, which is dependent upon our knowledge of radio propagation, has been neglected.

The amateur enjoys a rather unique position in this complex problem. Located as they are throughout widely scattered sections of the country, the amateur is able to add much to our fund of knowledge of radio transmission by making simple geographic comparisons. Slightly increasing his numbers on the 2-meter band, and greatly increasing them on the 6 and 1 ¼-meter bands would provide sufficient data and observations that it appears wholly possible that qualitative, as well as quantitative, answers might be supplied.

For example, it is not difficult to realize that v-h-f DX lies well within the scope of these recommendations for future research into tropospheric propagation (Historical and Technical Survey, Vol. 1, Committee on Propagation, NDRC, page 26):

1. Effects on atmospheric reflection of variations of frequency.
2. Determination of frequencies permitting greatest security under various meteorological conditions.
3. Measurements of signal strength and characteristics of the transmitted signal.
4. Phenomena responsible for long distance propagation in the 100 to 200-mc region.
5. Tropospheric propagation measurements over various types of terrain and water surfaces to determine coverage, etc.

No doubt as the number of active v-h-f amateurs increases some attempt will be made to analyze the DX observations. To get amateurs interested in the v.h.f., National is now putting the HFS receiver on the market.

The HFS is a superheterodyne receiver covering the range 27 to 250 mc. For increased efficiency it uses plug-in coils. It may be employed as a straight home station receiver on AM or FM as the second detector is super-regenerative. Or advantage may be taken of the double conversion principle using the regular station communications receiver. The i.f. of the HFS receiver is 10.7 mc.

It has been said that the future of radio lies in the very high frequencies. Possibly that may be true. In any case, it should include a good account of the radio amateur.

—Cal Hadlock, W1CTW

National NC

ADVERTISEMENT

W. A. Z. HONOR ROLL

C. W.-PHONE		
W6VFR	**40**	**197**
W8HGW	**40**	**192**
W6PFD	**40**	**190**
W2BXA	**40**	**187**
W6ITA	**40**	**185**
G2PL	**40**	**185**
W6ENV	**40**	**184**
W6MJB	**40**	**181**
W6SAI	**40**	**180**
W6ADP	**40**	**177**
WØYXO	**40**	**171**
W7AMX	**40**	**170**
W6SA	**40**	**170**
VE7ZM	**40**	**168**
W6PCS	**40**	**166**
W7FZA	**40**	**166**
W6DUC	**40**	**166**
W6AMA	**40**	**165**
W6FSJ	**40**	**161**
WØNTA	**40**	**161**
W7BD	**40**	**160**
ZS2X	**40**	**159**
W6TT	**40**	**157**
W7DL	**40**	**157**
W6WKU	**40**	**156**
W3EPV	**40**	**155**
W6FHE	**40**	**152**
W6NNV	**40**	**150**
W6OMC	**40**	**150**
W6LEE	**40**	**150**
W6ANN	**40**	**148**
W7DXZ	**40**	**146**
W6LER	**40**	**145**
W6PB	**40**	**144**
W6BAM	**40**	**142**
W6RDR	**40**	**134**
W6TI	**40**	**130**
W6YZU	**40**	**129**
W6MLY	**40**	**126**
W3BES	39	188
W8RDZ	39	188
W2GWE	39	186
W2HHF	39	184
W3JNN	39	180
G6ZO	39	180
W6EBG	39	179
W5ASG	39	178
W4CYU	39	176
W9ANT	39	175
W2PEO	39	174
W6DI	39	170
W2CYS	39	170
W8BKP	39	170
W6SN	39	165
W8NBK	39	165
F8BS	39	163
WØNUC	39	163
W3GHD	39	162
W6ZCY	39	161
W3DRD	39	160
G5DQ	39	160
WØGKS	39	158
W2HZY	39	157
W3JTC	39	156
G8KP	39	156
VK2DI	39	155
W9IU	39	154
PY1DH	39	152
G6QB	39	152
W4INL	39	151
W6GDJ	39	151
G5YV	39	151
G2AJ	39	151
W6KRI	39	151
W1NMP	39	150
G3DO	39	150
W2COK	39	150
W4DKA	39	149
W6AM	39	148
VE7HC	39	148
W9VW	39	147
G2WW	39	147
D2KW	39	147

C. W.-PHONE		
W6MVQ	39	146
W9NRB	39	146
W8LEC	39	146
W2MEL	39	145
W1AB	39	144
W6RW	39	143
W6KUT	39	142
W8SDR	39	141
VK2ACX	39	141
W6PKO	39	141
W6SRU	39	141
W9DUY	39	141
W6RM	39	140
G6BQ	39	140
W7BE	39	139
CE3AG	39	139
G3FJ	39	139
ON4JW	39	136
W2IOP	39	134
W6BPD	39	134
W6OEG	39	133
G5RV	39	132
G2VD	39	132
G2FSR	39	130
G5BJ	39	126
G3AAM	39	126
G5VU	39	124
W6PQT	39	123
W6EAK	39	123
G3AAK	39	122
W6QD	39	121
G5WM	39	120
G8RL	39	120
WØOUH	39	119
OK1AW	39	118
G6BS	39	117
G3QD	39	116
W6EPZ	39	114
W6UZX	39	114
G3TK	39	114
W7GXA	39	106
W7ETK	39	105
KG6AL	39	104
W6LEV	39	103
W6MI	39	102
W7ENW	39	101
W6LN	39	95
W6AX	39	93
G6PJ	39	76
W6BIL	39	73
VE3QD	38	161
W3IYE	38	161
W1JYH	38	156
W3EVW	38	156
W9RBI	38	151
W1BIH	38	150
W4OM	38	149
W8FJN	38	147
W1ENE	38	145
W2RDK	38	145
W2CWE	38	144
W2CYS	38	144
W8CVU	38	142
W2PUD	38	137
W1ZL	38	136
W1KFV	38	134
W4BRB	38	133
W4FPK	38	132
G8IL	38	131
W3ZN	38	130
G5CI	38	130
W2PQJ	38	129
G6LX	38	126
W9VND	38	125
W9TB	38	124
GW3AX	38	123
WØSQO	38	123
W9MZP	38	121
W9YNB	38	117
W5CPI	38	113
W8WWU	38	111
OK1CX	38	110
W6LRU	38	109

C. W.-PHONE		
VR5PL	38	109
W8VLK	38	107
G3ZI	38	107
G8IP	38	105
W6DLY	38	102
W6RLQ	38	102
W6ID	38	96
W6LN	38	88
G3BI	38	75
W3DKT	37	141
W2TJF	37	134
W3KDP	37	133
KP4KD	37	129
W4ML	37	122
W1KFV	37	121
G4CP	37	117
VE1EA	37	116
WØAZT	37	112
W4MZ	37	112
G4AR	37	108
G5MR	37	100
W2BLS	37	100
G3AAE	37	99
W2SGK	37	95
W6WJX	37	92
W6UCX	37	88
W2RGV	36	134
W3JKO	36	129
W9LNM	36	124
SV1RX	36	119
MD5AK	36	118
W2CNT	36	115
G2CNN	36	114
G2AKQ	36	112
OA4AK	36	110
F8VC	36	109
W2BF	36	108
TF3EA	36	104
W9FKH	36	103
W5BK	36	101
G2AO	36	100
W4DIA	36	98
G6WX	36	95
W2GUR	36	94
GW4CX	36	92
W7EYS	36	90
W8HSW	36	85
GM2AAT	36	75
W2DYR	35	123
W3LVJ	35	115
VE3AAZ	35	113
W8AVB	35	113
W9WCE	35	109
W6ZZ	35	102
W9CKP	35	101
G8VR	35	100
W3WU	35	98
W7BTH	35	91
G2AVP	35	89
W6CTL	35	88
W2WC	35	88
W6MUF	35	87
W8JM	35	86
D4ANM	35	80
G8RC	35	78
G3BDQ	35	74
W7FNK	35	72
CM2SW	34	132
W4DHZ	34	116
W4HA	34	109
W9FNR	34	103
W2GVZ	34	99
G8QX	34	99
G8KU	34	96
VK4RC	34	91
W8JM	34	89
G6XX	34	89
W2EMW	34	85
W2JA	34	84
W5CD	34	74
J4AAK	34	66

C. W.-PHONE		
WØDU	33	106
W4QN	33	104
W3AYS	33	89
WØFWW	33	85
G2LC	33	85
W5BK	33	79
GM2UU	33	79
W8PCS	33	78
G8VG	33	78
G3BFC	33	77
W6WUD	33	61
W2NXZ	33	61
W4LVV	32	104
W1BFB	32	94
HA1KK	32	78
W8QUS	32	75
W2AYJ	31	103
G6QX	30	82

PHONE		
W6DI	38	152
W6VFR	38	135
W4CYU	37	147
W1HKK	37	131
G3DO	37	125
G6LX	37	124
W7HTB	37	123
G2AJ	37	121
W8BKP	37	113
G2PL	36	128
G6BW	36	127
W2BXA	36	126
W1JCX	36	126
W8REU	36	123
W1FJN	36	119
W3JNN	36	118
W6PXH	36	118
G5YV	36	106
W6WNH	36	105
G6WX	36	105
W3DHM	36	96
F8DC	36	87
W6SA	36	80
W2DYR	35	126
W1NWO	35	122
W9RBI	35	121
W8BF	35	120
W1MCW	35	119
G3FU	35	115
GM2UU	35	107
W4OM	35	106
W6PCK	35	103
G8QX	35	100
W9HB	35	89
W2RGV	34	108
W8BIQ	34	100
W6CHV	34	99
W9CKP	34	91
XE1AC	33	125
W5ASG	33	118
W2ZW	33	115
W2PQJ	33	99
W4HA	33	97
W8QBF	33	87
VE3ZM	33	81
W2DRH	33	60
W4INL	32	94
W9BZB	32	94
W5LWV	32	87
W2HY	32	85
WØHX	32	82
W9GZK	32	72
W9WCE	31	87
W6UZX	31	82
W6AM	31	80
W9MIR	30	82
W8SXU	28	59
W2BF	27	52

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73, *Bil Harrison,* W2AVA

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HT-18—10 to 80 meter VFO with narrow band FM! Directly calibrated on 10, 15, 20, 40 and 80 meters. Clean keying, excellent stability, built-in regulated power supply. Can you ask for more? .....Complete **$110.00**

HT-17—10 to 80 meter CW xmitter with 10 to 20 watts output! Built-in power supply and antenna network. Ideal for fixed or portable operation. Matches any type antenna. Take one on your summer trip. New low price. (Less coils and xtals) **$47.50**

SX-43—Medium price with features found only in custom type receivers! 540 KC to 55 MC, and 88 to 108 MC. AM on all bands, FM above 44 MC. High fidelity or sharp communications reception. Phono input. For the discriminating amateur who demands excellent performance. Price, less speaker....**$169.50**

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HT-9—The best value in a 100 watt transmitter. 75 watts on AM phone. Complete with tubes but less only coils and xtals.....**$350.00**

T-54 **TELEVISION** Missing television fun? Treat your YF and the kiddies to the pleasures of TV. 7 inch tube gives clear, brilliant pictures. Powerful FM sound system. Push button tuning on **ALL** 13 channels. Superb engineering and expert workmanship. Women will appreciate the graceful design and simplicity of operation. T-54, 7" TV set in handsome silver gray steel cabinet. **$169.50** Complete, ready to operate.
MODEL 505 — Same as T-54 except in rich, hand-rubbed mahogany cabinet.....**$179.50**

SP-44—Skyrider Panoramic. Actually see the signals on the band. Find the empty spots. You'll have lots more completed QSO's. An essential in every shack. Ready to use at a new low price. ...**$49.50**

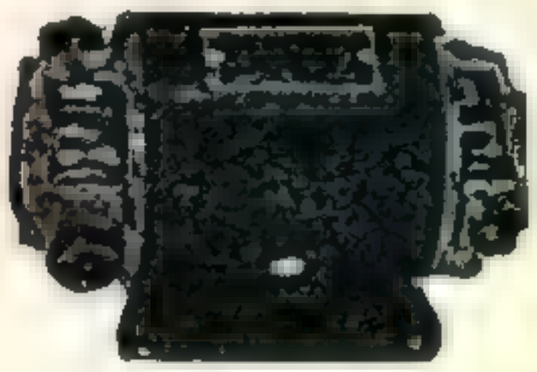
S-40A—A moderately priced receiver with excellent performance. Popular with all hams. RF stage, BFO, RF and AF gain controls, automatic noise limiter, tone control, electrical bandspread, built-in speaker. Covers 540 KC to 43 MC **$89.50**

SM-40—"S" Meter for use with S-40 receiver .**$16.00**

S-38—Lowest priced communications receiver! Many features found only in more expensive receivers. 6 tubes, 540 KC to 32 MC, AC/DC. Take it with you—use it anywhere. Built-in speaker. Price.....**$47.50**

Complete Hallicrafters Catalog Available

GOING MOBILE? - DON'T MISS THIS BIG DYNAMOTOR BARGAIN



Ideal for that mobile transmitter, PA amplifier or emergency rig! Compact—only 3¾" dia. 6½" long. (This job won't take your entire luggage compartment). **Lightweight**—only 6¾ lbs. complete. **Powerful**—12 volt input gives 680 volts at 210 ma; 6 volt input gives 300 volts at 210 ma or 265 volts at 300 ma. **High efficiency**—ball bearings minimize friction loss. **Dependable**—constructed for U.S. Navy, inspected, tested, original packing. With built in RF hash suppressors and mounting plate. *Item CRO-5* **$8.95**
Send for data sheet giving full performance curves.
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FL-8 QRM SLICER

SICK AND TIRED OF QRM?
Enjoy QRM-less QSO's by using the FL-8 audio filter adapter as described on page 15, June CQ. Can be attached to any receiver in less than 2 minutes. Amazing results! FL-8 Range Filter **Each $1.95**

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Are you receiving the **HARRISON HAM-A-LOG** containing ham news, construction tips and listings of our special offers of standard equipment and HSS bargains? Send in your name today! **Please be sure to include your call letters.**

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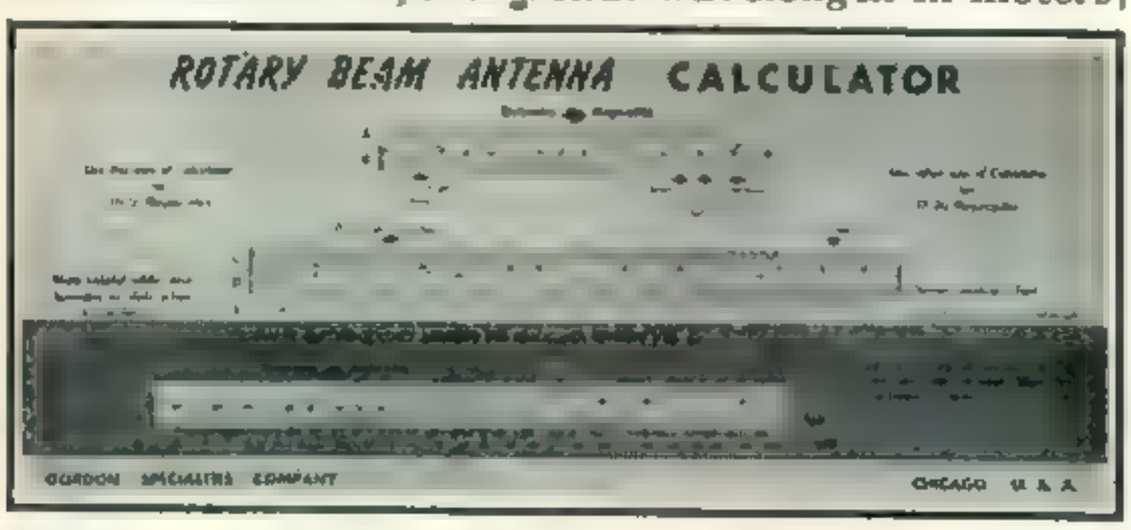
PARTS AND PRODUCTS REVIEW

Rotary Beam Antenna Calculator

Gordon Specialties Company has announced a unique new rotary beam antenna calculator. By completely eliminating mathematics or computations it is an invaluable time saver. It is only necessary to set the frequency desired opposite the arrow marker and then read: wavelength in meters;



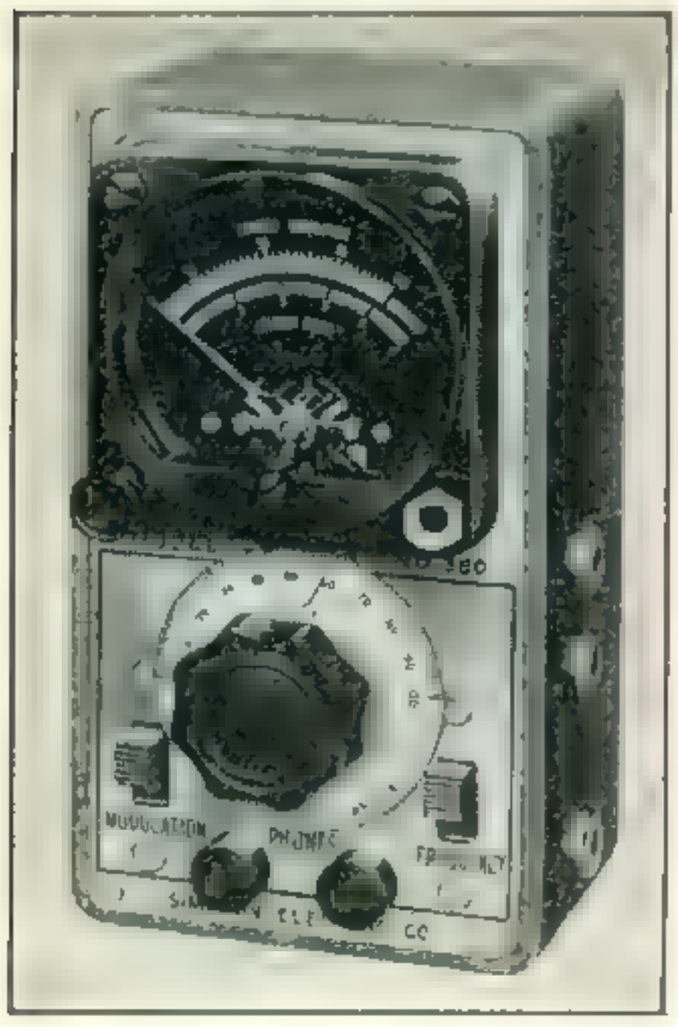
director, driven element and reflector lengths in feet; half wavelength in feet; full wavelength in feet; element spacing in feet from 0.10 to 0.25 wavelength; capacity and inductance for resonance between 5-60 mc. Coverage is from 10 to 30 mc. Full details may be obtained from the manufacturer at 542 S. Dearborn St., Chicago 5, Ill.

New Literature

Amphenol Engineering News, a monthly bulletin describing in detail the latest products and developments in the radio and electronics industry is now being distributed. To be placed on the mailing list write American Phenolic Corporation, 1830 South 54th Ave., Chicago 50, Ill.

Wavemeter and Modulation Indicator

The new Simpson Wavemeter is an accurate band-spread wavemeter covering each ham band with individual hand-drawn calibration curves and using a 0-100 microammeter as a resonance indicator. Separate plug-in coils for 10, 20, 40 and 80 are supplied. Coils for other bands are available at slight extra cost. Operation on 144, 235 and 420 mc employs a quarter-wave antenna section.



Provision is provided for headphones for use in station monitoring and quality control. A direct reading percentage modulation indicator is calibrated from 0 to 110%. A leatherette covered case, with separate compartments for the instrument and coils is available as optional equipment.

Variable Vacuum Capacitor

Eitel-McCullough, Inc. has added to its line a variable vacuum capacitor. Except for the glass, of all copper construction and with silver plated terminal surfaces, these variable capacitors are extremely compact for their high current and voltage ratings. The single unit VVC60-20 capacitor will handle 40 amperes r-f current at 20,000 volts. Additional details may be obtained directly from Eimac, 196 San Mateo Ave., San Bruno, Calif.

Medium Power Amplifier

Capable of delivering 50 watts output (ccs rating) to any type antenna of low impedance, the Sonar SRT 75 employs the VFX 680 NBFM exciter. The VFX 680 is link coupled to the AMP 50 amplifier,

which is powered by the PS 50. The AMP 50 is a medium power amplifier using the 2E22 power pentode with high-efficiency plug-in coils. All the units are assembled in a crackle-finished, rack-size, chrome-trimmed table cabinet. Descriptive literature is available from Sonar Radio Corp., 59 Myrtle Ave., Brooklyn 1, New York.

Double Permeability Tuned I-F Transformer

The Hammarlund Manufacturing Company is now producing a double permeability tuned i-f transformer to be operated in the region of 50 kc. The small size and extreme selectivity of this unit make it extremely practical for an outboard i-f stage. Used in conjunction with any reasonably stable communications receiver it provides razor sharp tuning, and freedom from interference. A single i-f stage using two of these transformers will provide the following attenuations:

6 db at	.8 kc bandwidth
20 db at	1.4 kc bandwidth
40 db at	2.8 kc bandwidth
60 db at	5.0 kc bandwidth

The transformer is ruggedly constructed utilizing the sturdy pillar-type frame work with heavy bake-

(*Continued on page 83*)

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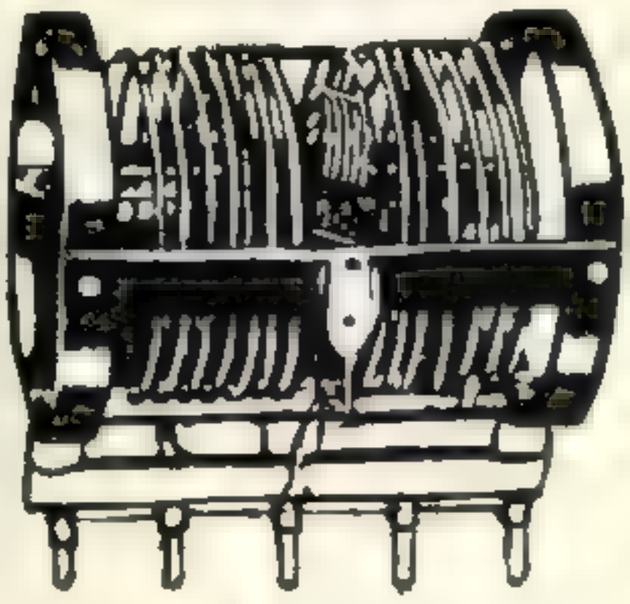

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4.5 - 5.7	4.5
5.7 — 8.0	4.5
8.0 — 11.0	4.5
11.0 — 14.0	2.5
14.0 — 18.0	1.5

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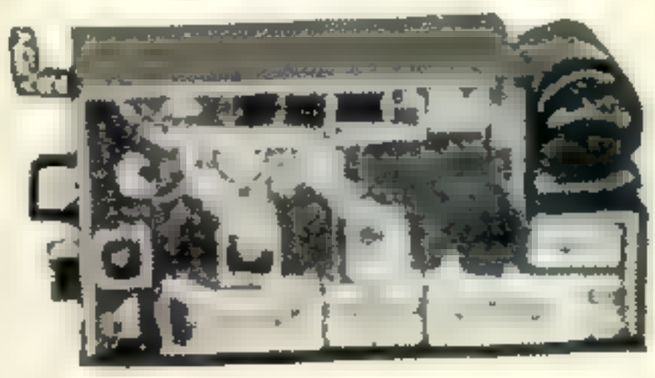
Your Cost, **79c EA**

BRAND NEW! RUGGEDLY BUILT! SCOOP!

110 MC. REC. BARGAIN

BC-733 D Localizer Receiver

Freq. 108-110 Mc; Tube complement: 10 tubes— 1 — 12SQ7, 2 — 12SR7, 1 — 12A6, 1 — AH7GT, 2 — 12SG7, 3 — 717A. NEAR NEW CONDITION. Companion to the glide path receiver. Also con-



tains 90 and 150 cycle band-pass filters. Has the best AVC system yet developed; can use parts or use as a model for construction. 10 tubes, crystals, relays, etc. Schematic included. Don't pass this up! At only.....**$3.95**

2 for $7.50

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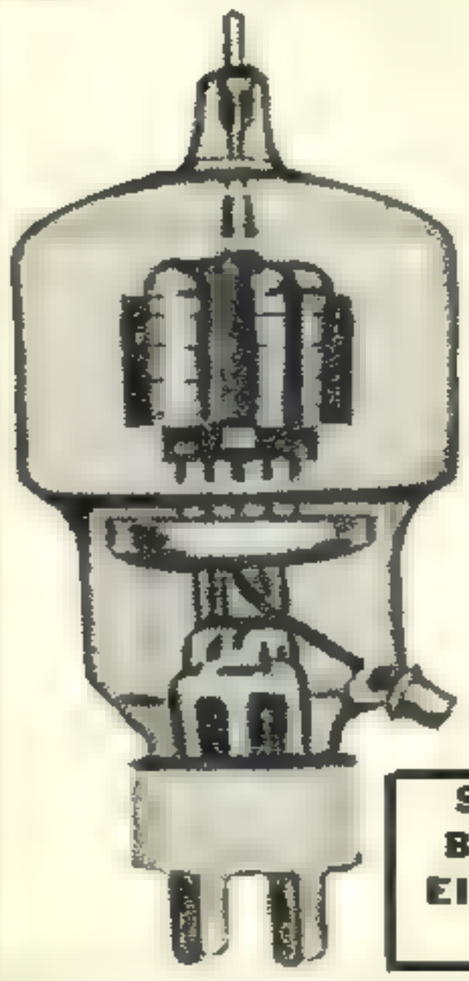

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Easy to Set-up

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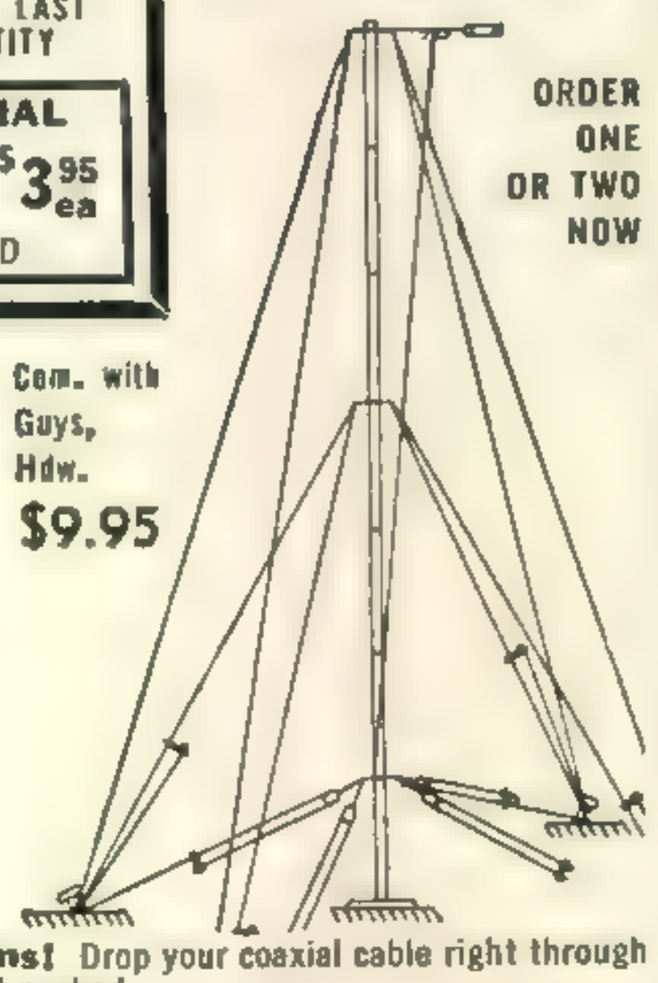

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Kilowatt 75 ohm Amphenol Twin Lead, per 100 ft. **$7.20**	2051 — Tube Thyratron.....**.39**
Four Gang—150 Mfmd. Variable.....**.95**	New Surplus Jones 6 and 8 prong plugs.....**.24**
4 Mfd. @ 600V — Oil —Round Can.....**.69**	Toddle Switces SPST plus spring return.....**.24**
PL 55A Phone Plugs.....**.18**	SCR 522 Dynamotors, PE94C, New.....**$3.95**
375E Tuning Units.....**$1.95**	SCR 522 Receiver Conversion Kit and Instructions (Less Dial).....**$3.50**
807 — **New** — Boxed..**$1.49**	ACN Dial For Above.....**$3.00**
2C40 Lighthouse Tube.....**.95**	3 Gang 410 Mmfd. Per Sect Cond. Excellent quality..**$2.95**
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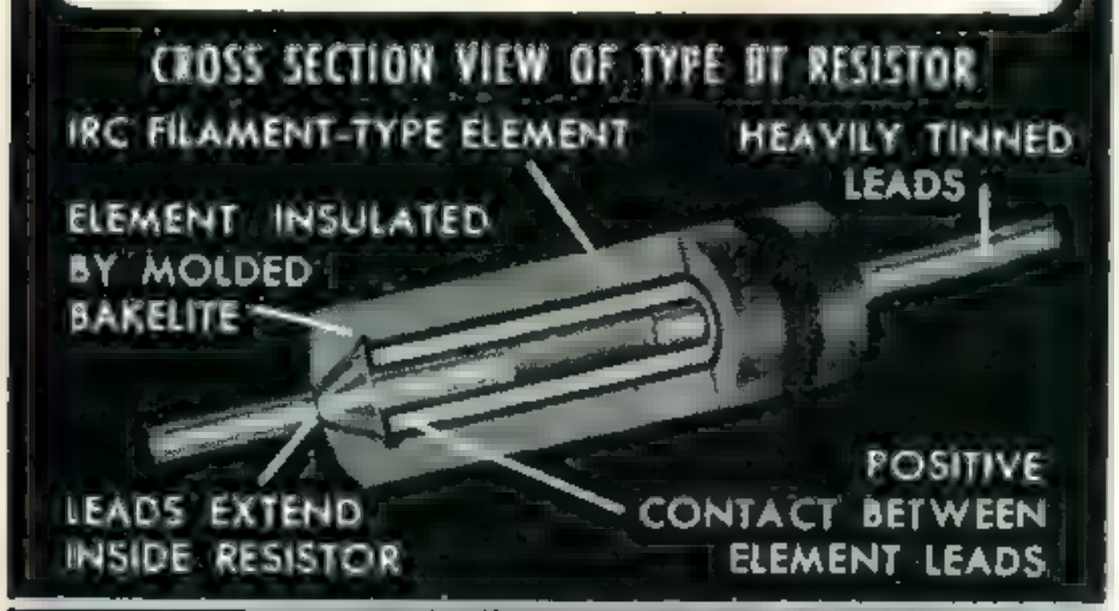
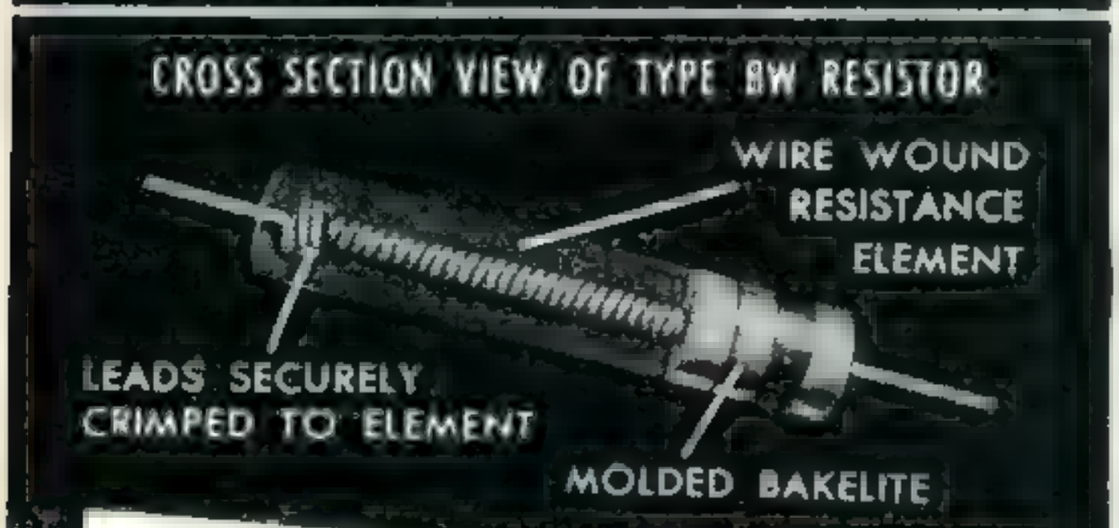
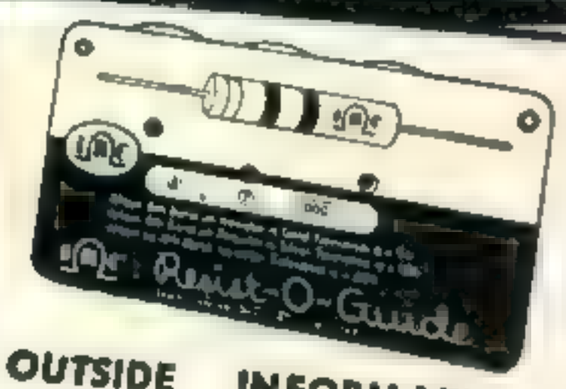
Here's INSIDE Information

On How to Choose Resistors for High or Low Ranges

Take an electron's eye view of two fine resistors—IRC's type BT for high ranges, and type BW for low ranges. See why these famous midgets give you better wattage dissipation, lower operating temperature, maximum protection against moisture and humidity, improved all-'round performance and *lasting* stability. Then specify IRC type BT Insulated Composition, or BW Insulated Wire Wounds next time you order resistors for your rig.







OUTSIDE INFORMATION on how to identify resistors by color. IRC's Resisto-Guide makes it easy to identify resistance ranges at a glance. Be sure to get yours. At all IRC Distributors. Or send 15c in stamps or coin direct.

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IT HAS BEEN quite some time since any member of the editorial staff wanted to write a "private" note to the readers. However, there has been a recent addition to the masthead that calls for special attention. A single line indicating that R. Leigh Norton, W6CEM, is a new contributing editor belittles the importance of the event. Leigh brings to *CQ* a know-how and savvy that has been a byword to his personal and business associates through the years. Many of the younger *CQ* readers may not have heard of W6CEM, but we guarantee that it won't be too many months before that void in their education has been filled in.

Leigh's ham career dates from Christmas day of 1930 when his unsuspecting parents gave him enough cash to buy the parts to build a "short-wave set." The thing turned out to be something like a Super Wasp, but even at that tender age Leigh started to improve on some else's design—that is, after finding out that the small winding on the home-made coils was supposed to be the tickler instead of the other one. The astonishment that followed the discovery of guys talking to each other on these short waves lead rapidly to W6CEM in September, 1931.

W6CEM promptly plopped into the first phone band handy, which happened to be 3500–3550 kc. As Leigh puts it, "I was well on my way to parking there forever when a group of villans in the name of the FRC decided that there would be a new class of license known as the 'Unlimited Amateur Radiotelephone' for those who wanted to use 'phone on 80 and 20 meters." Since the ink on W6CEM wasn't dry for the required year the probationary period was whiled away on 40 c.w. It was at this point that Leigh made two startling discoveries: One, that it was actually possible to communicate by means of dots and dashes, and that there were amateurs having call letters that didn't start with W. The DX bug had bitten! Since that time W6CEM has been c-w DXing, with occasional short lapses on v.h.f. and low-frequency phone.

Leigh was with *Radio* from 1938 to 1941 and has been with Eimac since then. Presently he is connected with the development of new tubes and their allied circuits. Amply exposed to v.h.f. and u.h.f. every day, he's only too glad to stick to the relatively low frequencies at home, "where a piece of wire is just a piece of wire and not a full-wave antenna."

Pet ham subjects are trick receivers and equally trick transmitters. Pet beefs are key clicks and the seriousness with which some people take their DX-ing. Leigh is married and has three girls and a pair of boys. Working 40 zones with that sort of competition is a real problem, but says Leigh, "It's a lot of fun." Between his work and his family, not to mention DX, W6CEM has a jampacked schedule that promises to *CQ* readers some of the finest material to appear in the technical literature. We are mighty pleased to have him on the staff and we know you'll soon be equally enthusiastic.

HENRY

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Henry Radio stores in Butler, Missouri and 11240 West Olympic Blvd., Los Angeles, California have complete stocks of all Collins amateur equipment for immediate delivery. Also complete stocks of all other amateur receivers, transmitters, and parts. I promise you that you can find nowhere else lower prices, more complete stocks, quicker delivery, easier terms or more generous trade-ins. I give you 10-day free trial and 90-day free service. I promise that you will be satisfied on every detail. Write, wire, phone or visit either store today.

Bob Henry
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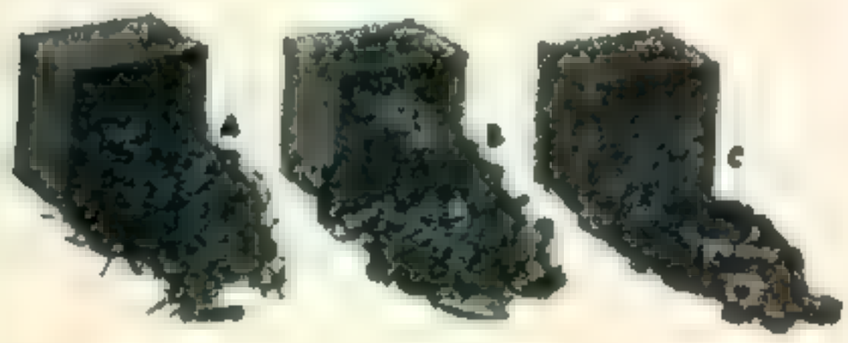
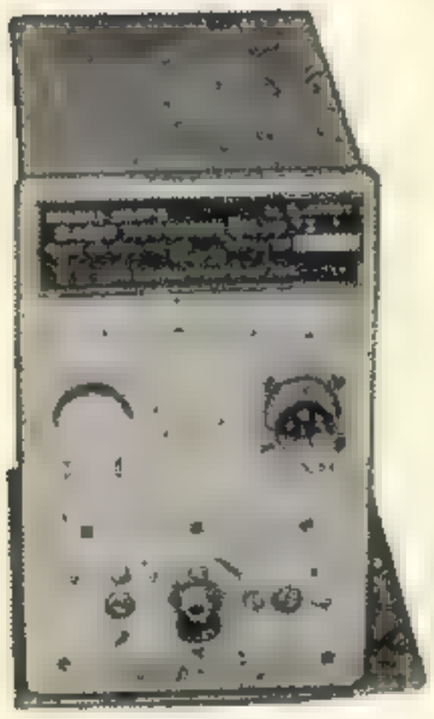


A—Resistor kit composed of 150 or more assorted wattages. Containing various resistors of up to 10 megohms. Many with gold bands. An honest-to-goodness bargain... .Box **2.65**
B—Condenser Kit. Contains assortment of 25 various condensers including 2-2Mfd. 600 V. filters, 1-1000 Mfd. 15 V. filter 4-1 Mfd. 400 V. paper by-pass, 3-3 gang midget trimmers, etc.... ... ...

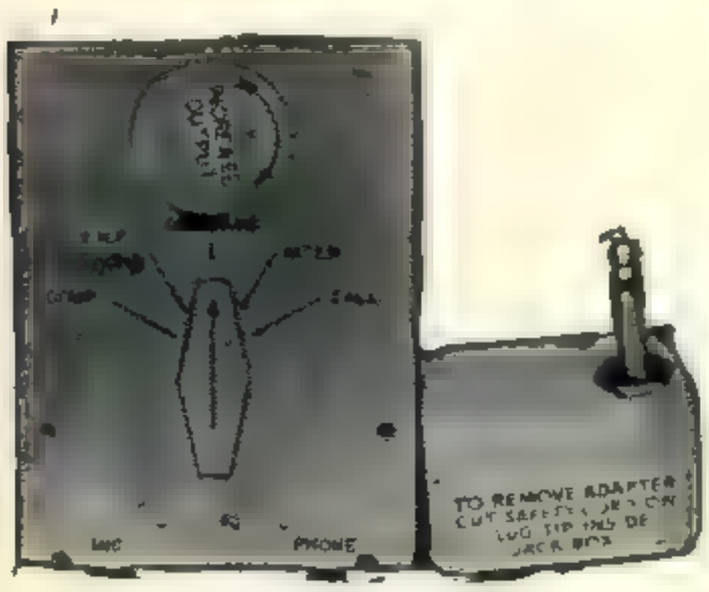


MARKER-BEACON RECEIVER

Can be adapted to radio controlled devices. Was used by pilots to flash a signal lamp on aircraft instrument panel when in range of a beacon transmitter. Responds to modulated signals over a variable range of 62 to 80 Mc. Tube plates and filaments operate directly from 24 V. DC. Can be adapted for radio control of experimental apparatus opening garage doors, etc. Circuit diagram and parts list included on either model shown below:

BC-357—contains 12C8 and 12SQ7 tubes and sensitive relay (size 5⅝" x 5¼" x 3¼").
Price.....**$2.95**

BC-1033 — contains 6SH7, 6SL7 and 12SN7 tubes, sensitive relay (size 5⅜" x 5¼" x 3¼").
Price.....**$3.50**



JACK BOX, BC-1366

Contains 2-pole 5-position switch, rheostat, two phone jacks, etc. In aluminum case 3¼" x 4⅜" x 2¼". Complete with headphone set adapter to match high to low impedance.
Price.....**$1.25**

ALL PRICES F. O. B. INDIANAPOLIS

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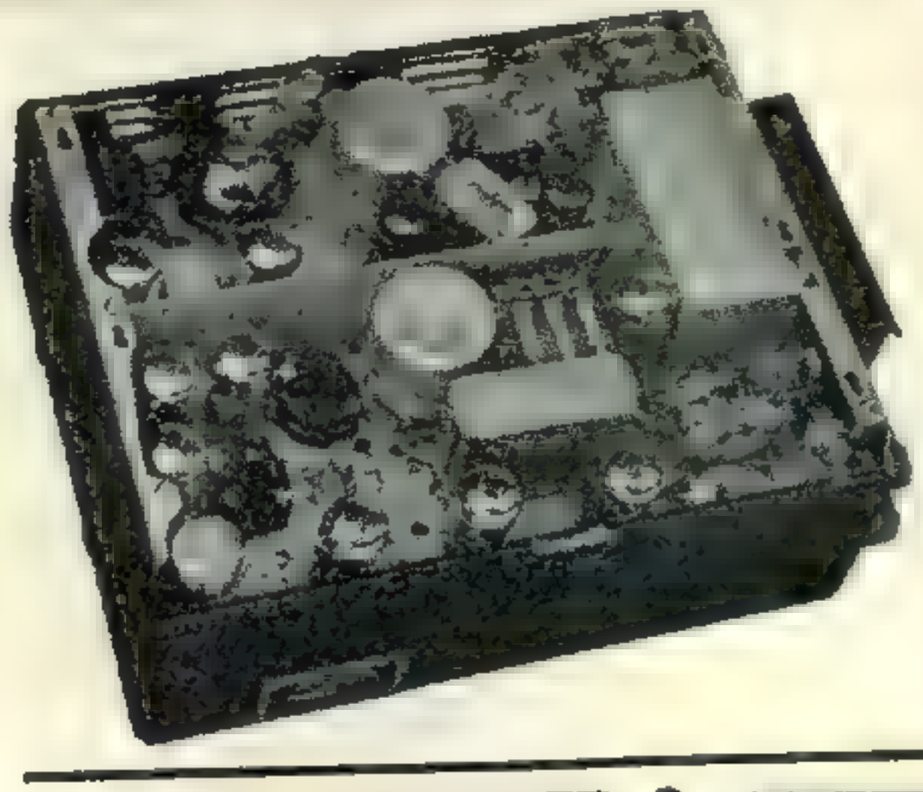
537 N. CAPITOL AVE.
INDIANAPOLIS, IND.

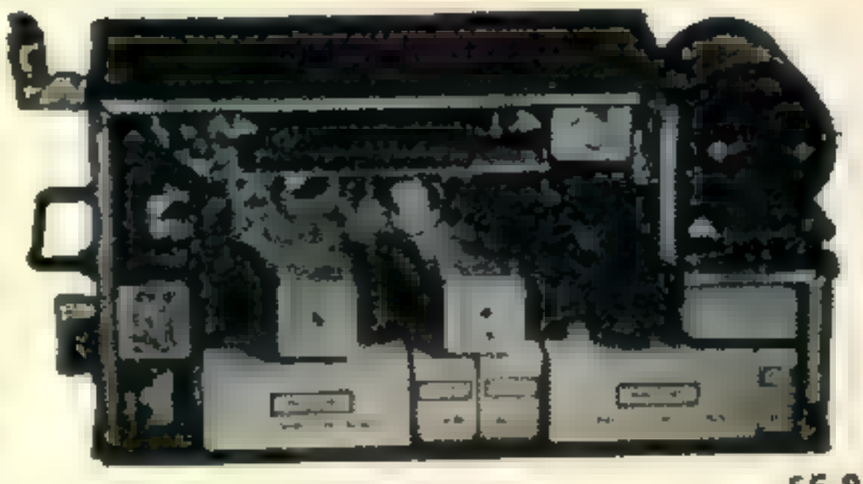


BC-645 ULTRA HI-FREQUENCY TRANS-MITTER-RECEIVER

You read about it recently in QST! Originally operated in the frequency band from 450 to 500 Mc. Can be converted to 420 Mc. amateur band. Consists of complete transmitter and modulator system, and receiver.
Complete, Brand New with 15 tubes, **$11.95**

BC-733D LOCALIZER RECEIVER

A part of aircraft blind landing equipment. Operates on any six of its predetermined crystal controlled frequencies in the range of 108-120 mc. Contains 10 tubes, three of which are WE-717-A's and crystals. Ideal receiver for conversion to 144 mc. ham band or mobile telephone bands For 24 V. DC operation. Size 14½" x 7" x 4⅝".



Price with dynamotor..... **$5.95**
Price without dynamotor..... **$4.95**

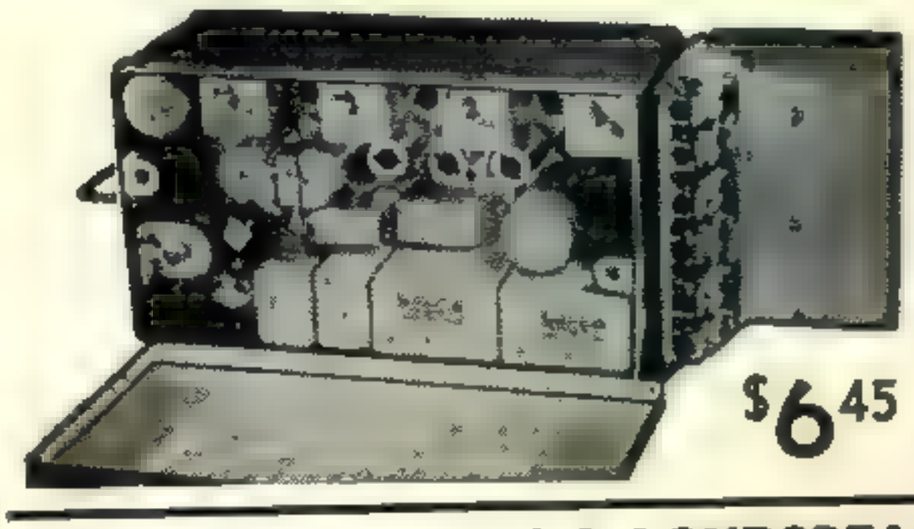
$6.95

C-1 AUTO PILOT AMPLIFIER

Were used to control operation of Servo units, causing them to move the control surface of airplane in one direction or the other in response to signals received. The complete amplifier includes one rect. 7Y4, 3—7F7's for amplification and control, 3—7N7's for signal discrimination, 1 power transformer, 6 relays, 4 control pots, chokes, condensers, etc. Convert for use on radio controlled models, doors, etc. Operates from 24 V. DC. Size 9¼ x 6¼ x 7⅝". Complete.

AIRCRAFT RADIO RANGE FILTER

For helpful reduction of QRM on crowded CW bands. When attached to output of any communications receiver:
1—Will pass signal of 1020 CPS, eliminating others.
2—Will pass voice frequencies and eliminate 1020 CPS code signal.
Compact, light weight, with switch. Size 2¾" x 2⅝" x 3¾".
Price.....**$2.25**



$6.45

R-89/ARN 5A GLIDE PATH RECEIVER

Formerly used for blind landing but adaptable to many other uses such as receiver for new police or citizen's band. Band of operation 326-335 mc. on any of three predetermined crystal controlled frequencies. Contains eleven tubes, 6 relays and other valuable parts. For 24 V. DC operation. Size 13¾" x 5¼" x 6⅜"
Price, complete as shown. **$6.45**

LS-3 LOUDSPEAKER

Size 8" x 8" x 5". Weight 12 lbs. 6" PM type speaker with output transformer to match. 4000 ohm impedance. Housed in heavy metal case. Openings protected by louvres and screen.
PRICE, slightly used.....**$8.95**

TERMS: CASH WITH ORDER

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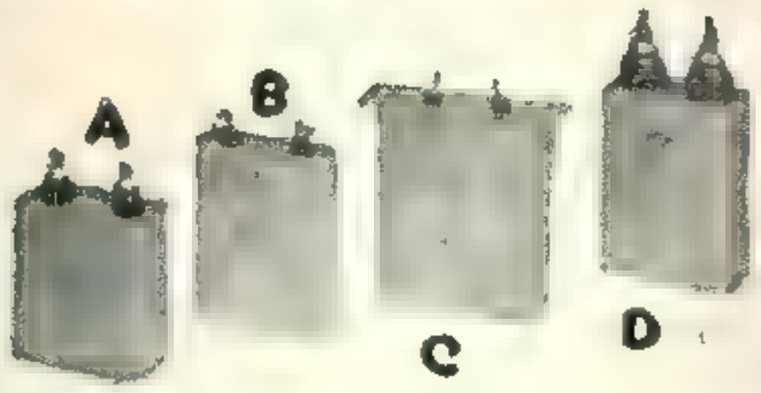
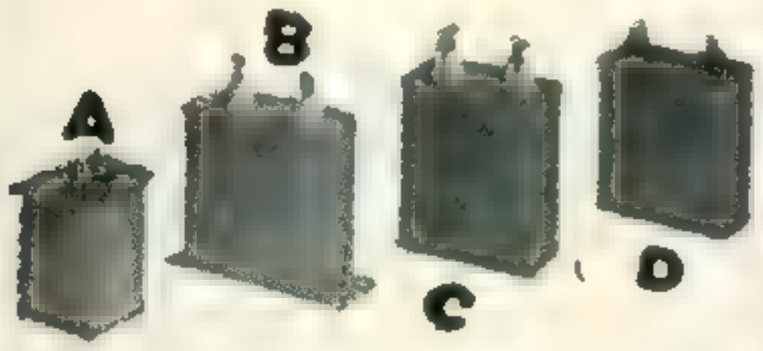


(A) Filter condenser, G E Pyranol, oil filled 8 MFD @ 1000 volts DC working voltage about 1½" x 4" x 5" high, shipping weight about 3 lbs. Brown porcelain stand off insulator terminals.....New **$2.00**

(B) Filter condenser, Sprague, oil filled, 8 MFD @ 1000 volts DC working voltage size about 1" x 4" x 5" high, shipping weight about 2 lbs.....new **$2.00**

(C) Filter condenser, 8 MFD @ 700 volts DC working voltage. Oil filled, well insulated terminals. Size about 2" x 4¼" x 5" high, with mounting flanges, gray metal case shipping weight about 4 lbs. new **$1.25**

(D) Filter condenser Cornell Du-Bilier, 1 MFD @ 4000 volts DC working voltage, oil filled. Size about 2¼" x 4" x 7" high over all. Shipping weight about 4 lbs. Heavy stand-off insulator type terminals. ..... New **$3.75**



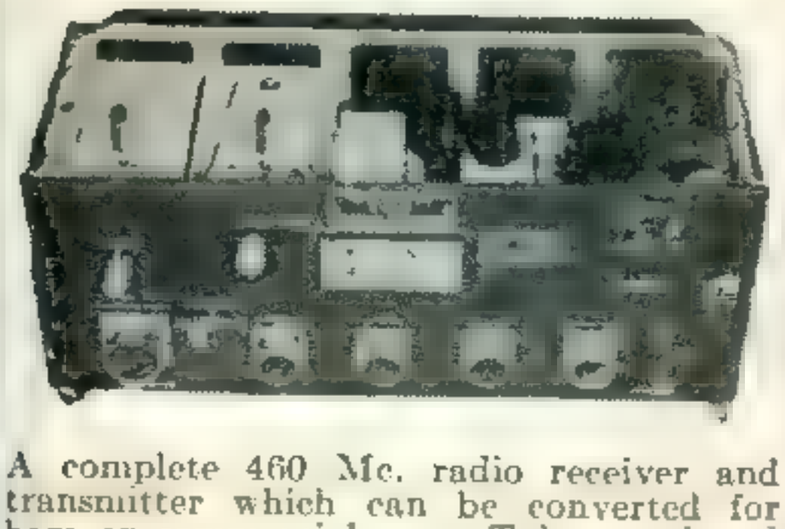
(A) Filter condenser, oil filled, 4 MFD @ 300 volts DC working voltage, size about 2" x 2" x 3½" high, shipping weight about 2 lbs. .....new **35c**

(B) Filter condenser, Aerovox, oil filled 4 MFD @ 1000 volts DC, brand new, size 1¼" x 2½" x 5", shipping weight about 2 lbs.....**$1.25**

(C) Filter condenser, Industrial Condenser Corp., oil filled, 1 MFD @ 3000 volts DC working voltage size about 2¼" x 3½", x 5" high, well insulated terminals. Shipping weight about 3 lbs.....new **$2.00**

(D) Filter condenser, Industrial Condenser Corp., oil filled, 4 MFD 2000 volts DC working voltage, porcelain insulated terminals, size about 2¼" x 3½" x 5" high, shipping weight about 3 lbs.....new **$2.50**

APN-1 RADIO ALTIMETER

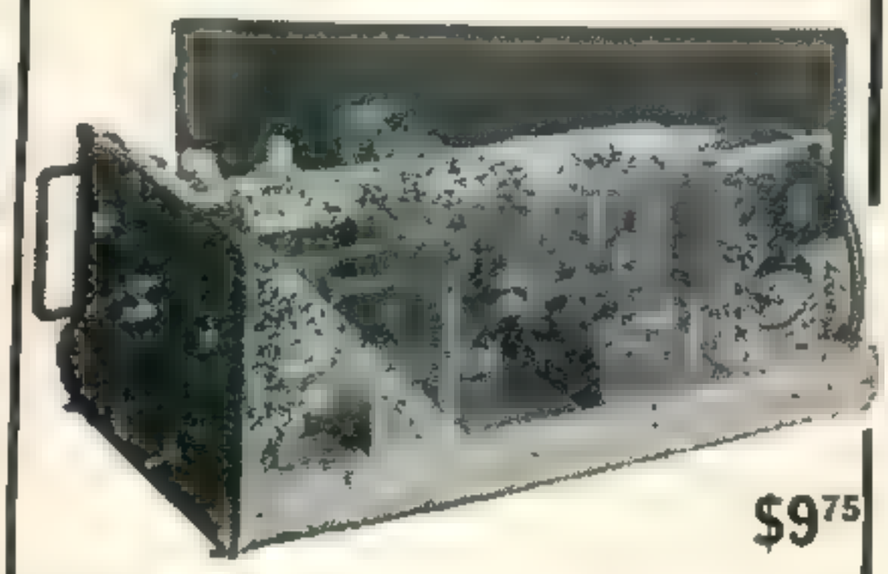


A complete 460 Mc. radio receiver and transmitter which can be converted for ham or commercial use. Tubes used and included: 4-12SH7, 3-12SJ7, 2-6H6, 1-VR150, 2-955, 2-9004. Other components such as relays, 24 V. dynamotor, transformers, pots, condensers, etc. make this a buy on which you cannot go wrong. Complete as shown in aluminum case 18" x 7" x 7¼".....**8.95**

TELRAD 18-A FREQUENCY STANDARD

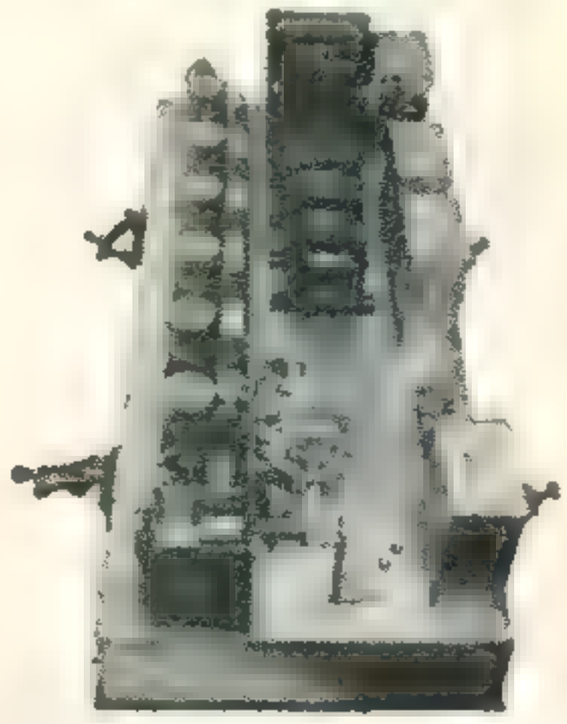
Checks signals in the range of 100 Kc. to 45 Mc with a high degree of accuracy. Self-contained power supply is 110, 130, 150, 220, and 250 V. 25-60 cycle AC. Complete with tubes, dual crystal, and instruction book. Brand new. Price..... **24.95**

T-39/APQ-9 RADAR TRANSMITTER



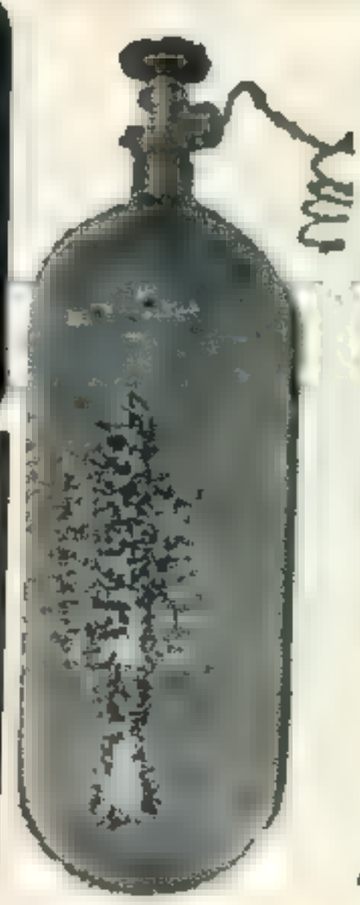
$9.75

Contains many excellent parts for the VHF experimenter such as a cavity oscillator using 2-RCA 8012 tubes rated at full output to 500 Mc. Tubes are forced air cooled by 24 V. DC motor, which is easily converted for 110 V. AC operation. Other valuable parts such as a pair of 807's, 2-6AC7, 1-931 and 1-6AG7 tubes; ceramic switch, potentiometers, gears, revolution counter, etc.



BC-406-A Receiver—Brand new. Manufactured by Western Electric. 165 to 205 mc operation IF frequency 19.5 mc. IF band width 7 mc. Easily converted for operation on other ultra-high frequencies. Operate from 110 V., 60 cycle A.C. Worth many times this amount for tubes and parts.

Tubes—one 5T4, two 6SJ7, four 6SK7, one 6N7, five 954's, one 955, one 6F7, one 6N7. Also contains small 110 V. operated motor..... **$34.50**



OXYGEN TANKS

Aviators oxygen breathing bottles. Non-shatterable. Comes of two types.

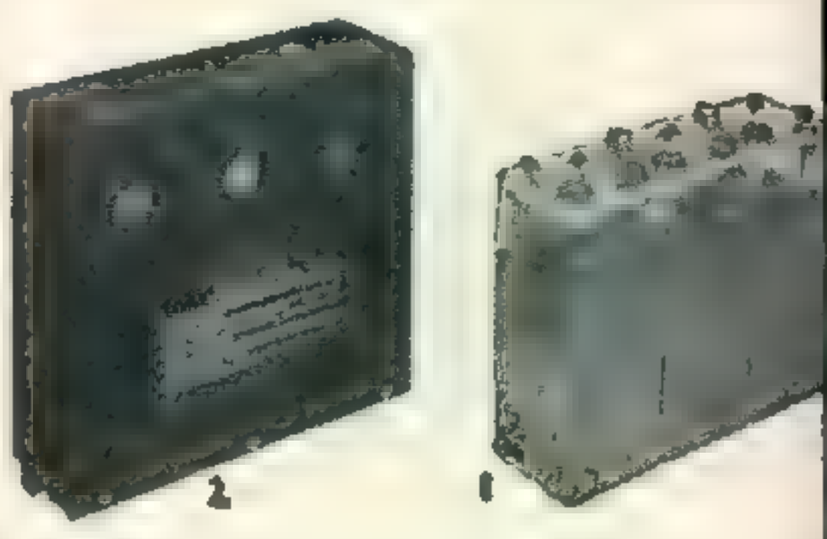
(A) Withstands 2000 lbs. pressure.

(B) Withstands 500 lbs. pressure.

5.95

A B

WILLARD LEAD ACID CELLS

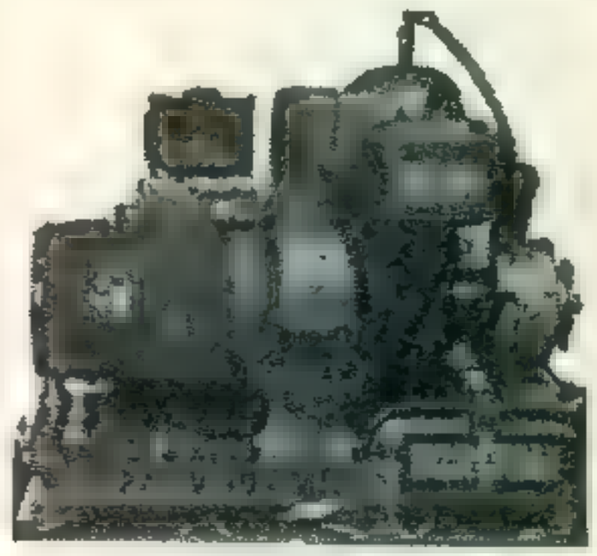


6 V. (New) (Dry-charged)..... **$3.0**
6 V. (In metal carrying case) (Add electrolyte specific gravity 1.265) (Drugstore). **$4.0**

T-17-B CARBON MICROPHONES

(Handmike) (New)..... **1.35**

(HRU) DC POWER SUPPLY



24-28 V. at 70 amp. 2000 watts gasoline engine generator with electric starter. Power supply which can be used to operate 24-28 V. equipment, start airplane engines, charge batteries, as a welding machine, lighting system, or for amateur radio station. 21½", 17½" x 24⅝". Wgt., 115 lbs..... **79.50**

BUSS FUSES—CARTRIDGE TYPE, packed ten to a box.

6 amp. 250 V. non-renewable	**$.40**
3 amp. 250 V. non-renewable	**.40**
6 amp. 250 V. renewable	**.75**

3AG 10 amp. Glass fuses **.02**. **1.35** per hundred

TERMS: CASH WITH ORDER
Address Orders to Dept. B

AMERICAN SURPLUS PRODUCTS CO.

537 N. CAPITOL AVE.
INDIANAPOLIS, IND.

All Prices F.O.B. Indianapolis

WAR SURPLUS BARGAINS SOLD AS USED UNLESS OTHERWISE SPECIFIED

Cord CD-132, has PL-55 type plug and 9″ cord, with spade type lug tips.....35c

Sylvania type 1N26 crystal.....NEW 35c

Resistor 20 watt, one-half ohm.....NEW 10c

Fuse holder for type 3AG fuses.....NEW 10c

Amphenol co-axial chassis connector, new type 83-1R.....40c

Amphenol co-axial angle plug adapter, used, type 83-1AP.....40c

Connector, bakelite insulation, male and female section, 6 pin polarized.....50c

Canvas bag, moisture & fungus proofed, with carrying strap, leather re-enforced corners, weight 3 lbs., size 9″ x 14″ x 12″ high. Ideal for tool case, for sportsmen, etc.....NEW $1.00

HAND SET T-S-10-G—Sound-powered telephone. No batteries required for operation: connect to any two wires or fence, or ground, etc. by convenient clips included. Price.....NEW $9.50 each

ARGON BULBS—2 watt ideal for transmitter tuning, night light and etc. Price .35c each. $3.00 per carton of ten.

Microswitch, completely weather-proofed, metal-clad or cased, rated 15 amps at 115 volts, normally open type, plunger has override feature. NEW 35c

Battery type BA-38, 103.5 volts, used in Handie-Talkie, Mine detectors, or for any purpose where low current drain is required. Size 1″ x 1″ x 11½″ long. Out-dated, but tests O.K.....NEW $3.00

Tube socket, RCA, for 866 or similar type tube bases.....NEW 35c

Tube socket, wafer octal type, excellent mica insulation.....NEW 10c

Tube socket for 813 type, Johnson type 237 NEW 60c

Tube socket, for Acorn type tubes, made by Millen Co.....NEW 20c

Tube socket, porcelain octal type, less mounting ring.....NEW 10c

First IF transformer for BC348 type receiver, 915 kilocycles.....NEW $1.00

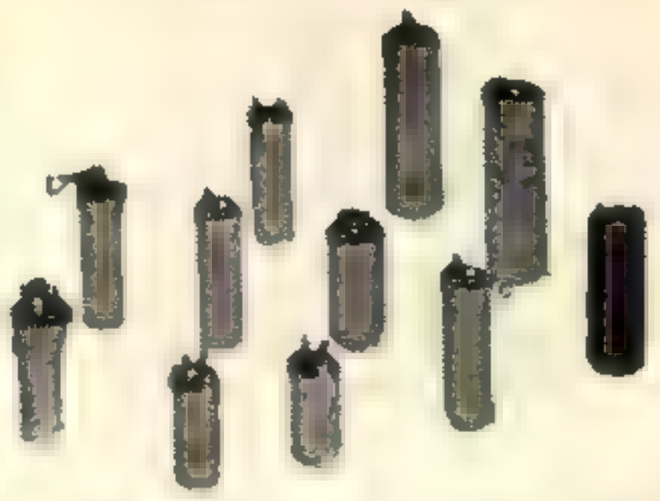
Ohmite tap switch, model 111, 9 taps, non-shorting, will handle 10 amps at 115 volts..... NEW 35c

Kit of potentiometers, twenty-five assorted sizes carbon and wire-wound.....NEW $2.25

Resistor, voltmeter multiplier type, rated at 2 megohms, 2 kilovolts insulation, 1 MA maximum current, about 1″ diameter x 5½″ long, mounts in clips..... NEW 75c

Resistor, 100 watt type, 5 sections having 7500, 3000, 23, 23 and 75 ohms (total of 11,269) ohms resistance. 1¼″ diameter by 8½″ long.....NEW 35c

CONDENSERS



30 MFD—300 V AC G.E. Pyranol.....NEW **$3.00**

Three gang trimmer condenser assembly, each adjustable 5 to 45 mmfds.....NEW **25c**

Neutralizing, for 6L6 or 807 tube applications.....**10c**

Variable tuning condenser, 7-17 mmfds 1½″ shaft, ceramic insulation, single hole mounting.....**20c**

Padder type variable, 100 mmfds the maximum, screw driver slot in shaft for adjustment.....NEW **20c**

Mica condenser kit, kit of many values and assorted capacities and voltages, about 100 condenser per kit. NEW **$1.98**

Electrolytic, mounts in octal tube socket 10, 5 and 15 MFD @ 100 working volts DC. Aluminum can NEW **50c**

Electrolytic, 50 MFD @ 350 V DC Mallory F P aluminum can.....NEW **50c**

Cornell-DuBilier 2MFD @ 1000 V DC. 1″ Diameter 5″ tall.....NEW **$1.35**

Cornell-DuBilier—4 MFD 600 V DC 1″ diameter 5″ tall.....NEW **$1.00**

Electrolytic 30 MFD @ 450 V DC mallory F P aluminum can.....NEW **50c**

Electrolytic 40 MFD @ 450 V DC Mallory F P aluminum can.....NEW **75c**

Electrolytic, triple 20 MFD @ 25 V DC Mallory F P aluminum can.....NEW **35c**

Electrolytic, 30 MFD @ 150 V DC. Mallory F P aluminum can.....NEW **35c**

Paper, .05 MFD @ 400 V DC Solar.....NEW **10c**

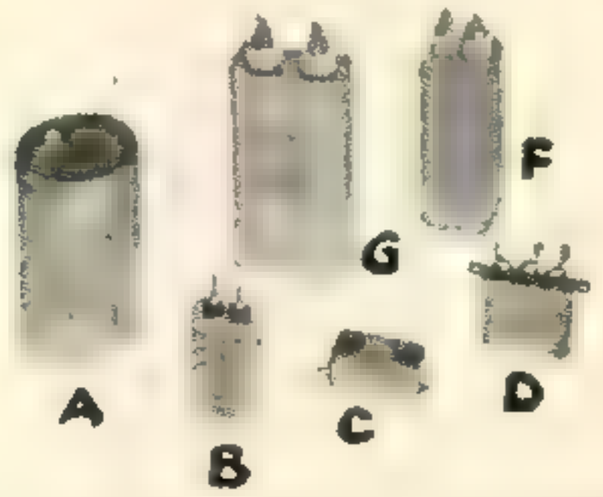
Paper, .5 @ 400 V DC Aerovox.....NEW **10c**

Condenser-Aerovox
.25 Mfd. 20,000 DC working volts. Size 4″ x 8″ x 16″ overall height. Weight 28 lbs. Price **$4.50**

Projection Lamp - GE Mazda Type T-20
115 V. 1000 watts Clear glass Bayonet socket. Size about 2¼″ dia. x 9½″ overall height. Weight 1 lb. Price **$2.50**

Neon Glow Lamp - Westinghouse
¼ watt 115 V. clear bulb. Candelabra screw-base. Packed 10 to each carton. Brand new. Price, per box **$1.00**

Resistor Kit
Various wattages and electrical values most commonly used. Many goldbands. Price - 500 for **$4.49**



(A) Condenser, electrolytic, 100 MFD @ 300 volts, 2½″ diameter, 4½″ high, metal can, shipping weight 2 lbs. Brand NEW.....**$2.00**

(C) Condenser, bath tub type .1 MFD @ 1000 volts DC NEW.....**20c**

(D) Condenser, Tobe, oil filled, 3 x .1 MFD @ 600 volts DC at.....**25c**

(F) Filter condenser, Aerovox, oil filled, 2 MFD @ 600 DC working volts size about 1½″ x 1½″ x 5″ high, shipping weight about 1 lb. .....NEW **35c**

(G) Condenser, Cornell-DuBilier, oil filled, 4 MFD @ 1000 volts DC working voltage, size about 1″ x 2½″ x 5″ high, shipping weight 2 lbs. NEW **$1.75**

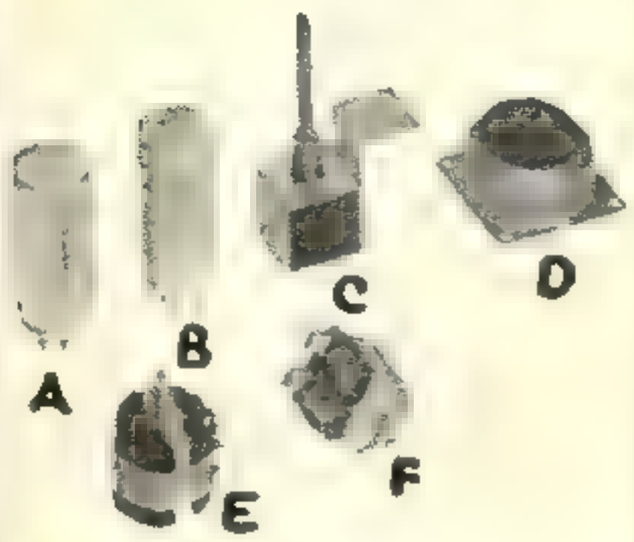
Bath tub type .3 MFD @ 50 V DC .....NEW **10c**

Bath Tub type .1 MFD @ 1000 V DC NEW **20c**

Oil filled 3 x .1 MFD @ 600 V DC tube **$1.95**

1.75 MFD @ 50 V DC...NEW **15c**

.5 MFD @ 600 V DC...NEW **15c**



(A) Vibrator, Radiart VS-3, for 6 volt battery operation, used in vibrator supply PE104—which is used with BC654A transmitter-receiver Type J-4.....NEW **$1.95**

(B) Vibrator, Radiart VS-3 for 6 volt battery operation, used in vibrator supply PE104—which is used with BC654A transmitter-receiver. Type J6 (probably exactly the same as [A]).. NEW **$1.95**

(C) Relay, 110 volt 60 cycle AC plunger type for door interlock. NEW **85c**

(D) Lord Shock Mount, heavy duty type, base size 3″ square x 1½″ high—⅜″ diameter bolt may be used. NEW **35c**

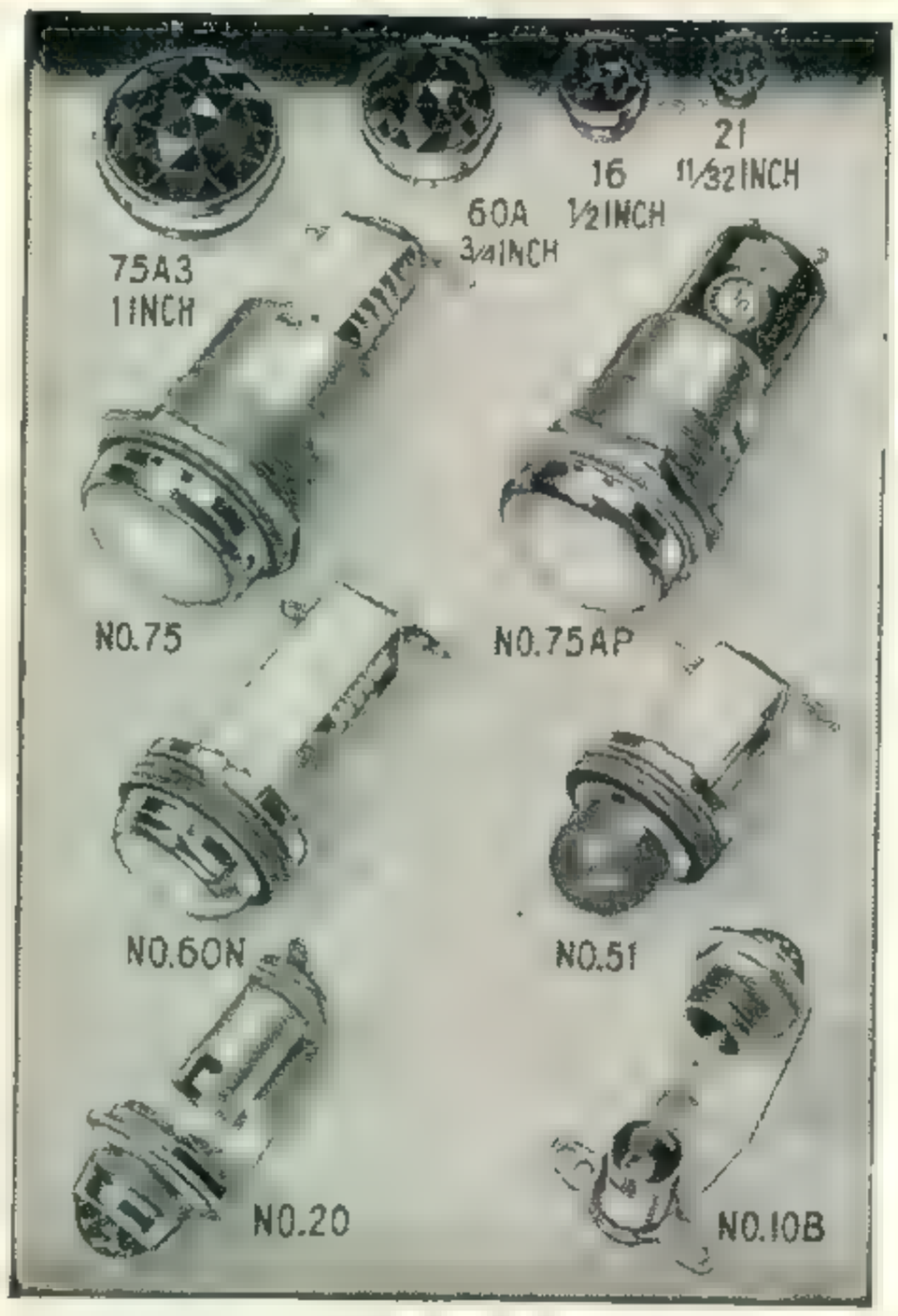
(E) Dual volume control wirewound, each section 25,000 ohms. NEW **35c**

(F) Toggle switch, bat handle, DPDT. NEW **30c**

DRAKE

PILOT LIGHT ASSEMBLIES

WILL BEAUTIFY YOUR INSTRUMENT PANEL



Give your instrument panel that professional look with *Drake Jewel Light Assemblies!* These highly finished glass jewels and bull's-eyes, attractively mounted in polished chrome-plated holders, are exactly the same as those used by leading commercial manufacturers throughout the country. Efficient, good-looking, well made — *Drake Pilot Light Assemblies* will give you the best in performance and, at the same time, real pride in the appearance of your panel.

Ask your local jobber to show you the big Drake line. If he doesn't have a complete stock, write us for catalog CQ — just off the press.

Socket and Jewel LIGHT ASSEMBLIES

DRAKE MANUFACTURING CO.
DEPT. A, 1711 W. HUBBARD ST., CHICAGO 22

DX

(*from page 50*)

who now signs KH6PY, seems to be having a wonderful time in this location. He finds it somewhat nicer than being just another W6. *YV5AB* is going to see if he can work c.w. to catch up with some of those Russian zones that aren't heard on phone. Now maybe somebody that needs YV can catch up with him. A card from A. Sass, QSL manager for Hungary, gives the correct address for all cards to HA amateurs. We've added it to the QTH list. Charles Earp, W3DKT, enjoyed a recent trip to Holland, and visited the shacks of *PAØEP*, *PAØBB*, *PAØIN* and *PAØUN*. He is greatly impressed with the FB job they have done in spite of the acute shortage of radio parts over there.

Your old friend Bob Jardine, G6QX, sent in his list of zones and countries, but says that he gets very little time for DX chasing. The following is an excerpt from his letter: "In November I become an old-timer, 20 years on the troubled air, and as I sit at the cottage door with my grandchildren seated around me, gazing wistfully upward, like old Kaspar in the poem 'Blenheim,' I tell of the days when a radio transmitter had one tube which glowed hot, and a receiver known as a Reinartz with two tubes was 'It.' I tell of first contacts with distant places, and little Audrey says, 'Then why all that junk in the racks, now Gramp, when you did it with one little bulb and a clothesline?' The answer is Progress, my dear, Progress." Amen, amen.

Hold These Dates!

October 29, 30, 31 November 5, 6, 7

CQ's World Wide DX Contest

1 WEEKEND C.W. 1 WEEKEND PHONE

Spread the word around overseas. Complete rules in a later issue. We are going to help you take the pain out of keeping a DX contest log. Special "World Wide DX Contest" log sheets are being prepared so that they may be used in duplicate—you keep one for your log and submit one with your score. Send directly to the New York office for your forms. Ask for as many as you or your friends need. Forms will be mailed in ample time for the contest. Watch for additional details on the rules and regulations. It's a contest for big and little DXers alike.

A newsy letter from Ken Neifert, *KB6AD*, tells of QRO to 450 watts, and the addition of a rotary 8JK for 10 and 20, which is 15 feet above an 80-foot ex-control tower shack! Ken says he has been out of QSLs since late February, but has 1000 new cards ordered. When they arrive, he will answer all presently unanswered cards, and in the future will QSL all stations worked via A.R.R.L., without first waiting for their cards. Sounds good to me, Herb, but I hope he doesn't forget mine. *KB6AA* and *AB* have been gone for some time. *KB6AC* has left to become a KH6. *KH6KH/KB6* is still active on 20 'phone, but is having a short rest in KH6 for awhile. *KB6AE* is not as yet on the air, but expects to be on 10 phone before long. *KB6AF* has a rig on 20 c.w. but isn't very active, mostly due to a poor antenna, and of all things, BCL trouble. Is there no

WELLS

Guaranteed TUBES

- TRANSMITTING
- RECEIVING
- INDUSTRIAL
- SPECIAL PURPOSE

This is a Partial List of Tubes in Stock

TYPE No.	PRICE	TYPE No.	PRICE
2C26	.55	807	1.25
2C26A	.65	810	7.95
2X2/879	.80	813	7.85
3B25	3.00	814	4.25
3C24/24G	1.60	826	.49
5D21	6.00	10Y	.75
6AC7	1.10	829B/3E29	3.95
6AG5	.80	830B	2.25
6AK5	.80	832	2.75
6B4G	.95	832A	3.50
6C4	.75	836	1.75
6E5	.80	837	1.25
6SL7	.90	841	.85
6SN7	.90	864	.80
6V6	1.00	869B	29.50
12C8	.80	872A	2.45
12A6	.55	954	.65
VT33	1.00	955	.65
VT67	1.00	957	.65
RK34	1.00	1005	.70
VT52	.55	1148	.40
VR90	.75	1201	.40
VR105	.80	1616	1.95
VR150/30	.75	1625	.55
VT127	.25	1626	.65
211	1.15	1629	.50
304TH	7.25	2051	.90
304TL	3.75	7193	.35
GL471A	1.00	9001	.80
532A	3.50	9002	.80
559	1.25	9003	.80
801/801A	.95	9004	.85
803	8.75	9006	.80

Minimum Order $5.00

Write or Wire Us for Quantity Prices

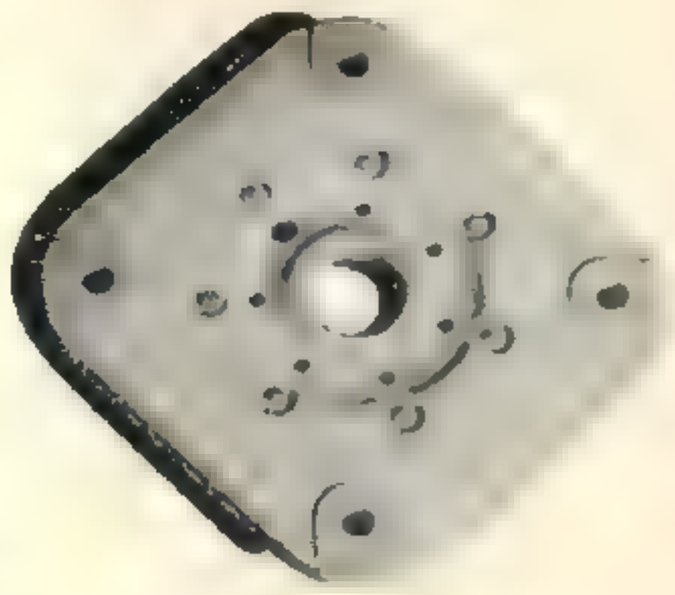
All Tubes Are Standard Make, Brand New and Fully Guaranteed

Prices Represent Tremendous Saving

The Type 826 UHF Transmitting Tube at 49c is a sensational example of Wells tube values. This all-purpose tube is capable of delivering 86 watts output as a class C amplifier!

AMATEURS

The new Wells Amateur Catalog H400C is now ready. Send for your free copy today. Hundreds of the highest quality radio items are listed at a fraction of their normal value.



Ceramic Tube Sockets for the 826 and 829B . . . 50c each

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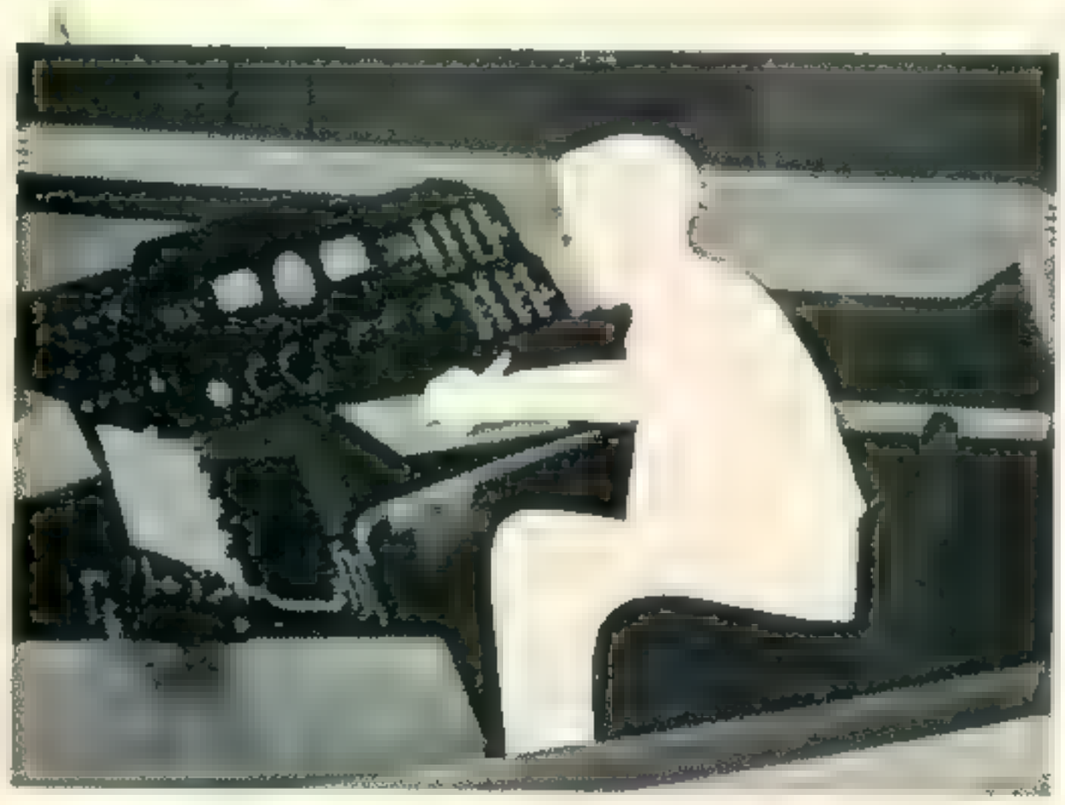
320 N. LA SALLE ST., DEPT. C-7, CHICAGO 10, ILL.

CAPITOL RADIO ENGINEERING INSTITUTE
Pioneer in Radio Engineering Instruction-Since 1927



Don't let others put you out of the picture!

Just look at the more than 3000 FM and standard broadcast stations predicted by the FCC by the end of the year—the scores of applications and permits for Television stations—the new applications radio-electronics is finding daily in every type of industry—the mobile communications systems now being utilized everywhere from backwoods logging operations to metropolitan taxicabs the new time high in overall radio-electronics manufacturing.

No wonder men with modern, technical training are needed in every branch of radio-electronics. *Don't let others put you out of this picture!* NOW is the time for *you* to take the time to prepare yourself for the important career jobs this great industry expansion is making possible. CREI home study training can show you the way by providing you with the "tools" with which to build a firm foundation of ability based on a planned program of modern technical training.

In our proved method of instruction you learn not only *how*, but *why*! This is real, honest-to-goodness practical training for which thousands of radio technicians have enrolled during the past 21 years.

It costs you nothing to read the interesting facts. There is no obligation. Send the coupon now.

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Let us prove to you we have the training you need to qualify for a better radio job. To help us answer intelligently your inquiry—*please state briefly your background of experience, education and present position.*

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Mail me your FREE 24 page booklet.
Check field of greatest interest:

☐ Practical Radio-Electronics ☐ Television
☐ Broadcasting Eng. ☐ Aeronautical Radio
☐ Receiver Servicing ☐ Industrial Electronics

NAME.....
STREET.....
CITY.....ZONE.....STATE.....

☐ I am entitled to training under the G.I. Bill.

escape from this bane of hamdom? *KH6QL* has been operating portable of late on 20 and 40 c.w. using a Meissner, but he also has BCL trouble. Whatta life. Ken says he plans to take a 4 or 5-week leave around September and then return for possibly another year of rock duty. All present KB6 QTHs are: c/o C.A.A., Canton Island, South Pacific.

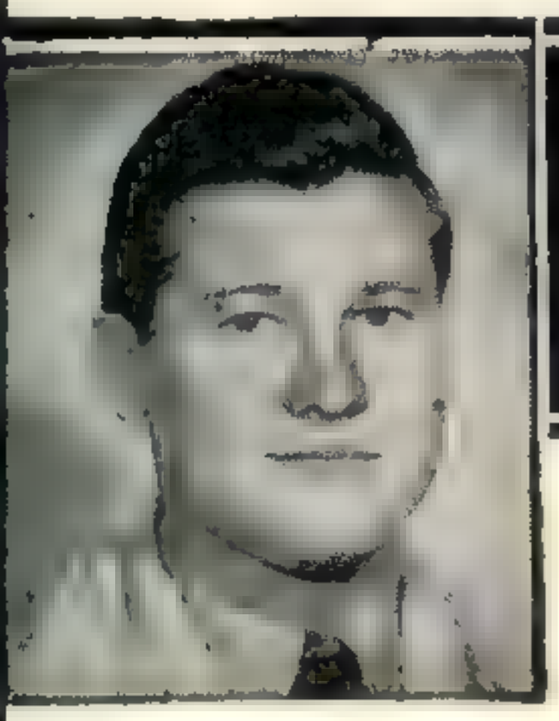
VU2PB, who is now in England and awaiting a G call, asks that we pass along this information regarding his QSL cards for Andaman Is. contacts. Due to his supply of these cards being limited, he was only able to QSL to those whose card he received. He has a few left yet, and if anyone has not received his card, he will be glad to send them one upon request. However, inasmuch as he has just recently sent out a number by regular mail, please allow plenty of time before asking for another.

Poor ole Pete, G2PL, is still after you, Herb, for that picture of Jane Russell. He is heartbroken because of no pic, and wonders if she doesn't care for her public, and most ardent admirer. I'm afraid that Pete is only one of many in this respect. Wasn't W6SA going to make the necessary arrangements with Jane? Let's kick him off the DX committee, and put her on instead.

Marv, W6VFR, still heads the Honor Roll with 40 and 197, and is not too far behind Guy Dennis, W6DI, in phone only efforts. I'm darned if I know how Guy finds so many countries on phone, but he again tops 'em with 38 and 152, and is hot after Zones 17 and 18 on phone. W6EBG, better known to some as "Eega Beeva Gene," is a relative newcomer to the Honor Roll, and has really been in there buzzin to get up to 39 and 179 in such a short time. Gene is very impatiently awaiting his 40th confirmation. You can hear him in there most any morning, trying to help things along by frantically working every UAØ on the band. To all of them he puts the same question: "Comrade OB, are you in Zone 19? If so, I need your card for W.A.Z. Please send your card direct to . . . etc." And from all of them, Gene gets this same interesting reply. "FB, FB, OM solid. Mni tks fer QSO 73 es cul." Ah me, what a cruel world 'tis for hams.

VE3AAZ has been transferred to the VE4 district. Looks like after his struggle to 35 and 113, he'll have to start all over again. Let's wish him lots of luck and DX. From VE3RL we learn that he is ex-*VQ8AK* from Mauritius, now attending college in Port Hope, Ontario. He explains, especially for the benefit of W3EVW, to whom we are indebted for a swell bunch of QTHs, why it takes so long to get a QSL from *VQ8AB* in Chagos Is. In addition to being a good distance from Mauritius, Chagos' only means of communication is either via ham radio, or a ship which only calls once every six months from Mauritius. So, if you work either *VQ8AB* or *8AS* at the wrong time, and miss the boat, better settle down for a long winter. Geoff certainly seems sold on Mauritius as a paradise for ham radio. Seems as though there are several ham paradises in this world, but California is never mentioned as one of them. The only thing I find in its favor is that someone told me about a ham who had to contend with 25 electric razors every morning, whereas the average here is only about 20.

From the way the Marathon lists are pouring in, it looks like there is plenty of interest there. With *C8YR* on almost every week lately, we may wind up with all Marathoners W.A.Z. this year. We also have a lot of newcomers to welcome to the Honor Roll, such as: W6UCX with 37 and 88; W6WNH, 36 and 105 on phone; F8VC, 36 and 109; W8SDR, 39 and 141; G6QX, 30 and 82; W7DXZ, 40 and 146, W4DKA, 39 and 149; W9MIR, 30 and 82 on phone;



ESSE Specials!

IN THIS July issue of CQ magazine, we are omitting our ads except for this page. Esse Radio Company, having been one of the first companies to enter the surplus sales field, has accumulated, over the past few years, odds and ends of all different kinds of electronic surplus gear and now, during the month of July, is going to hold its retail store open Monday through Friday from 9 AM to 5 PM and on Saturday from 9 AM to 3 PM and we cordially invite anyone to our store and will promise that, if you do come, you will see the most sensational bargains ever offered anywhere. We suggest that, if you have never been in our store, that you should come alone or invite your friends and all of you come as a group. Esse will go through all of its warehouses and bring to the sales floor, the largest assortment of electronic gear that has ever been assembled in one sales room. We want to clear our shelves of small quantity lots, obsolete equipment, too large of stock items and we want to become personally acquainted with our mail-order customers so we are putting prices "Down," "Down," "Down" until our customers will hardly be able to believe what they see when they enter our door.

On this sale, you will find radio hardware, parts, receivers, transmitters, modulators, power supplies, and all the vast array of things that are yet unsold that you have seen in previous Esse ads. You will find hundreds of aircraft parts, controls, and instruments. There will be radar gear galore. We are going to cram into every shelf, corner and nook of this sales floor, all the way to the ceiling, tens of thousands of items.

Please use this as an open invitation to visit our store and believe us when we state that, if there is an item that you desire that's on the surplus electronic market, that we probably have it and that the prices that we quote you will amaze you. Even if you have no intentions of buying and don't buy while visiting our store, it's almost an education to come here and examine the vast array of war devices that we have. Meet and talk to some of your friends, whom you have talked to over the air here in Indianapolis, and get together and exchange ideas on radio.

We want to meet and become better acquainted with customers from all over the United States and Canada and from anywhere else, so please take our word for it—"It will be interesting"—Come in!

ESSE RADIO COMPANY
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INDIANAPOLIS 4, INDIANA

ESSE Radio Co
130 W. New York St.
Indianapolis 4, Ind.

Unless Otherwise Stated, All of This Equipment Is Sold As Used
CASH REQUIRED WITH ALL ORDERS
Orders Shipped F.O.B. Collect

The NEW PIONEER

SQUARE HOLE PUNCH

The answer to your square hole problem

CUTS ANY SIZE LARGER

EITHER

SQUARE or ANGULAR HOLES

- Cuts clean
- No filing
- Simple operation

5/8" size—special

2.95 Net

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ROUND HOLE PUNCHES

5/8 Hole	$1.95	1-5/32 Hole	$2.30
3/4 "	1.95	1-11/64 "	2.30
7/8 "	1.95	1-3/16 "	2.30
1 "	2.15	1-1/4 "	2.30
1-1/16 "	2.30	1-3/8 "	2.65
1-1/8 "	2.30	1-1/2 "	2.95

Shurite PANEL METERS

2" Square case

Stock No:			
9305	0–25	D.C.M.A. Ea.	$1.45
9306	0–50	D.C.M.A.	1.45
9307	0–100	D.C.M.A.	1.45
9308	0–150	D.C.M.A.	1.45
9309	0–200	D.C.M.A.	1.45
9310	0–300	D.C.M.A.	1.45
9311	0–400	D.C.M.A.	1.40
9312	0–500	D.C.M.A.	1.40
9402	0–6	A.C. Volts	2.50
9403	0–10	A.C. Volt	2.50
9404	0–15	A.C. Volt	2.50

(Please order by stock number)

All prices F.O.B. Los Angeles (California Purchasers add 2½% sales tax). Include 25% with order—balance on delivery. Foreign orders cash. Minimum order..... $1.00

Get YOUR NAME on our mailing list. We'll keep you posted on merchandise available, new equipment and special bargains. Address correspondence to Dept. C7.

When in Los Angeles, drop in for a rag chew.

RADIO PRODUCTS SALES INC.

1501 South Hill Street · Los Angeles 15, Calif

Phone: PR. 7471 · Cable Address: RAPRODCO

W3ZU, 38 and 130; W7AMX, 40 and 170; W7DL; 40 and 157; W1BFB, 32 and 94; W2AYJ, 31 and 93; W4DHZ, 34 and 116; W6MLY, 40 and 126. Sure glad to hear from them all, and hope they will continue to send in the stuff.

Pete, W2GWE, still is rather inactive, but manages to haul a few out of the mess when he does get on, the latest being *ZD9AA*, *FK8AB*, *FO8AA*, *VS9GT* and *ZC1AL*, bringing him up to 39 and 186. I still wanna know how to work that last one. *TF3EA* is up to 36 and 104, with good ones like *UL7BS*, *CZ2AC* and *UF6KAB*. Incidently, we heard Einar struggling to work *UF6KAB*. It took about an hour of effort to finally land a decent exchange of reports, and all because of the terrific W QRM calling the UF6 every time he came back to TF3EA, or vice versa, of course smothering them both. This is a heckofa rotten practice that something should be done about. I'll bet the UF6 could have worked a dozen extra stations in the time it took to fight out this one QSO. We would all work more if we could only lean heavily on the receiver, and lightly on the key. What do you think? Through W6VFR, *RV2* asks the gang to be patient in waiting for his card, as he has not had any printed yet due to an FO8 call being in the offing. He also says that FO8AA is the only other legitimate FO8 on the air, and that you are most apt to find FO8AA on 10. A six-channel xtal rig is on the way to RV2, so perhaps soon we'll be able to hold him in one spot for an entire QSO! Marv wonders if anyone knows how to pry a QSL out of *VR4AA*. Quite a few of us are wondering the same thing.

Still from Marv comes the sad news that while we are trying to add Vatican City State to the Official Country List, we may not have anyone there to work when the job is done. HV2B, who said to QSL via Radio Vatican, apparently is unknown to a director of Radio Vatican, who in turn, is a personal friend of I1ARK. This is all very confusing, and while on the subject of confusion, here is some more. *YA3B*, whose mail has been returned to many, marked "Unknown," has reappeared quite recently. PY1DH worked him a short time ago, and was told that he is using 1 kw to a 3-element beam, and that his name is Pieter. W7FZA had a second QSO with *YA3B* and was thanked for his card and photo before making any mention that they had been sent. The YA explained that he had been to the interior on some sort of expedition and had made the mistake of dropping his P.O. box. All of this merely helps to pave the road to the nearest bughouse for us here,

W2WC, GW3ZV visiting the states, and W2GT snapped by W2JB.

They said it couldn't be done!

But thousands of HAMS, ALL over the country, are still talking about the new

R.P.S. - POWER CONVERSION UNIT

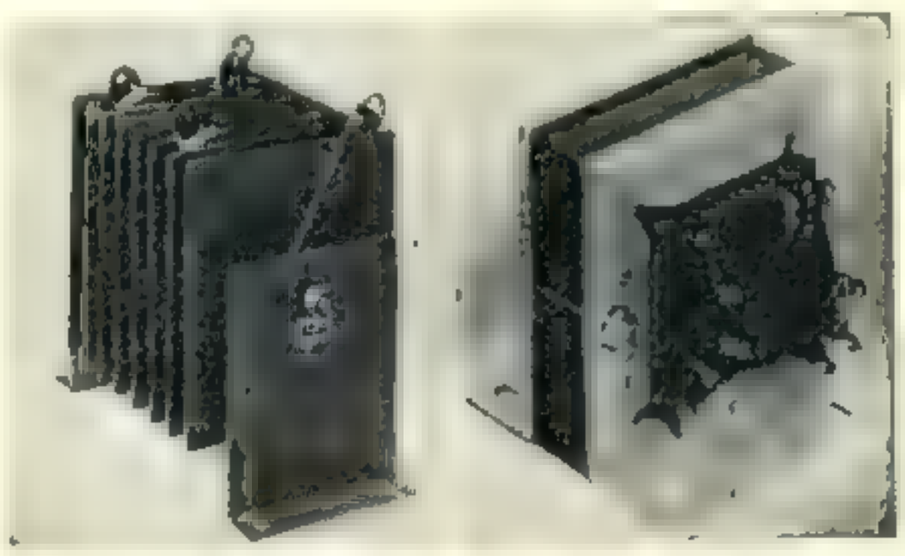
NOW AVAILABLE FOR IMMEDIATE DELIVERY

"CONVERTS ALL WAR SURPLUS d-c RECEIVERS AND TRANSMITTERS, etc. INTO a-c USE." NO REWIRING NECESSARY INSTALLED IN A FEW MINUTES—UNITS AVAILABLE FOR ANY RATING A FEW POPULAR MODEL SETS EASILY ADAPTED TO THE R. P. S. POWER CONVERSION UNIT· BC-453, BC-454, BC-455, BC-312, BC-348, BC-433, BC-624, BC-733, BC-946, BC-1206, R-89?ARN-5A, ARB, BC-457, BC-458, BC-459, BC-375, BC-625, BC-654, SCR-522, SCR-274-N, ARC-4.

★

INSTANT WARM UP

SELENIUM RECTIFIERS



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NO MAINTENANCE NO TUBES LOW COST COOL OPERATION

FREE INSTALLATION DIAGRAM SENT WITH EACH PURCHASE - R. P. S. POWER CONVERSION UNITS ARE AVAILABLE FOR ANY VOLTAGE AND AMPERAGE RATING. The R. P. S. POWER CONVERSION UNITS were designed especially for the radio amateur by VICKERS ELECTRIC DIVISION, Vickers Inc., a unit of THE SPERRY CORPORATION, manufacturers of selenium rectifiers. The transformers were designed by The Thermador Electrical Manufacturing Company and operate efficiently in conjunction with the rectifier prescribed.

IMPORTANT — HOW TO ORDER — The input rating of your dynamotor must not exceed d-c output rating of the rectifier. For example, dynamotor series DMDX — 12 v. 2 amps. — requires Rectifier No. S-295A and Transformer RPS-8883.

Shipping weights are listed — please contact your local freight agent for cheapest means of shipment — and include shipping charge with remittance.

ALL NEW—FULL WAVE VICKERS SELENIUM RECTIFIERS

Code Number Rectifier	d-c Output Volts	Amps.	Ship. Wt. in lbs.	Amateurs Net Price
S-295A	14	2	1.25	$ 6.95
S-458A	14	4.5	1.75	7.25
S-167A	14	10	3.75	10.95
S-292A	14	40	12	29.95
S-296A	28	1.8	1.25	5.75
S-344A	28	5	5.75	11.50
S-172A	28	10	6	16.50
S-291A	28	20	12	29.95
S-297A	28	40	23	52.25

ALL NEW THERMADOR TRANSFORMERS 50/60 Cyc—117 Volt Primary Rating

Code Number Transformer	Secondary Volts	Amps.	Taps See Note A	Ship. Wt. in Lbs.	Amateurs Net Price
RPS-8883	18	3		3.5	$ 3.65
RPS-8884	18	5.2		5.5	4.15
RPS-8885	18	12		12	5.95
RPS-8886	18	46		35	19.35
RPS-8888	36	2		5	3.95
RPS-8889	36	6		12	6.55
RPS-8892	36	12		25	11.35
RPS-8890	36	23		32	18.65
RPS-8891	36	46		78	50.25

NOTE A: All transformers have 3 extra taps — for example; 20, 19, 18, 17 volts and 38, 37, 36, 35 volts.

All prices F. O. B. Los Angeles (California purchasers add 2½% sales tax). Include 25% with order—balance on delivery. Foreign orders cash. Address correspondence Dept.. C7.

EXCLUSIVE PACIFIC COAST DISTRIBUTORS OF THE POWER CONVERSION UNIT

LOS ANGELES CALIFORNIA — RADIO PRODUCTS SALES, Inc. — 1501 SO. HILL ST. PRospect 7471

DX MARATHON

C.W.—PHONE

Zone 1

KL7KI	15	23
KL7KV	8	15

Zone 2

VO6EP	34	93

Zone 3

W6ITA	40	153
W6PFD	40	153
W6SN	40	134
W6ENV	40	134
W6NNV	40	116
W6RM	40	103
W6OMC	40	102
W6SRU	40	101
W6FSJ	40	92
W6ANN	39	109
W6HZT	39	105
W6PQT	39	96
W6WKU	39	94
VE7ZM	38	81
W6AM	37	114
W6LRU	37	82
W6OEG	35	80
W6UCX	34	71
W6MI	34	66
W6KRI	33	80
W6LER	32	53
W6CTL	31	63
W6MUF	31	53
W6UZX	30	55
W6QD	30	53
W6ZZ	29	73
W6WWQ	29	54
W6LN	27	49
W6BIL	26	39
W6MXN	25	38
W6AGT	24	44
W6MGZ	23	29
W6QWL	21	28
W6CID	20	21
W6OKL	18	35
W6UXF	17	18
W6VAT	15	15
W6KYV	14	25
W6EYC	11	16
W7PK	10	10

Zone 4

WØYXO	40	128
W9VW	40	118
W5ASG	39	146
WØGKS	39	115
W9GA	39	106
W8SDR	39	101
W9LM	38	111
W9NDA	37	98
W9TB	36	89
W8EWS	35	84
W9IU	34	89
W8GLK	34	88
W9LNM	33	80
W9CIA	32	93
VE3QD	31	85
WØSBE	31	84
WØEYR	31	84
W9WCE	31	81
WØCFB	31	79
WØDU	30	71
WØCMH	30	48
W5CPI	29	75
WØAZT	29	60
W5EWZ	29	51
W8MQR	28	57
W9MZP	28	49
WØUOX	27	57
W8BF	25	68
W5ZD	23	55
W8LFE	23	38
W8NKU	21	46
W4ALJ	21	35
W9EHS	17	29
W9KMN	15	13

Zone 5

W1AB	39	114
W1NMP	38	112
W1JYH	37	116
W3IYE	37	105
W3DPA	36	113
W1BIH	36	99
W3OCU	35	117
W2TJF	35	108
W2RGV	34	98
W3DRD	34	96
W1ENE	33	105
VE2WW	33	87
W2MEL	33	87
W1AWX	33	78
W3EPV	33	77
W4JFE	32	91
W2PQJ	32	89
W3WU	31	69
W4HA	30	85
W2EMW	29	70
W8JM	29	60
W1BFT	28	74
W3NOH	28	70
W4LVV	28	69
W2AW	28	67
W3AQT	28	59
W2BF	27	72
W1MRP	27	72
W4TO	26	76
W1CJH	26	66
W3RJS	25	52
W2OM	23	52
W2IOP	23	47
W2PUD	23	40
W4LK	21	46
W1HJ	21	44
W4JUJ	21	41
W1QCJ	21	38
W3NPZ	18	41
W4BRB	16	36
W4CV	13	22
W4HKJ	12	19

Zone 8

W8LZK/KP4	29	82
KV4AD	23	56
KP4KD	21	48

Zone 10

OA4AK	32	56

Zone 11

PY1DH	37	93

Zone 12

CE3AG	39	83

Zone 14

G3DO	37	103
ON4MS	35	76
F8BS	23	62

Zone 27

KG6AI	28	51

Zone 30

VK2DI	38	97

Zone 31

KH6PY	19	21

Zone 37

VQ3HGE	38	93

Zone 38

ZS2X	37	95

PHONE

Zone 3

W7HTB	37	105
W6DI	35	125
W6ITA	31	87
W6CHV	31	74
W6PCK	29	76
W6PXH	28	68
W6WUI	28	54
W6AM	26	46

Zone 4

W9RBI	34	87
W9NDA	34	79
W5ASG	32	99
W8NK	31	70
W8HUD	30	79
W5LWV	27	68
WØSBE	26	51
VE3BBZ	24	52
W5ERY	22	43
W9WCE	21	52
W8LFE	16	23

Zone 5

W1JCX	34	94
W1ATE	34	87
W1NWO	32	100
W1FJN	32	86
W2RGV	31	74
W4ESP	30	79
W4HA	28	70
W2IUV	28	62
W2DYR	27	66
W2PQJ	25	51
W1CJH	23	52
W1EQ	22	57
W2BF	20	44

Zone 6

XE1AC	32	111

Zone 8

KV4AD	21	43

Zone 10

OA4AK	22	29

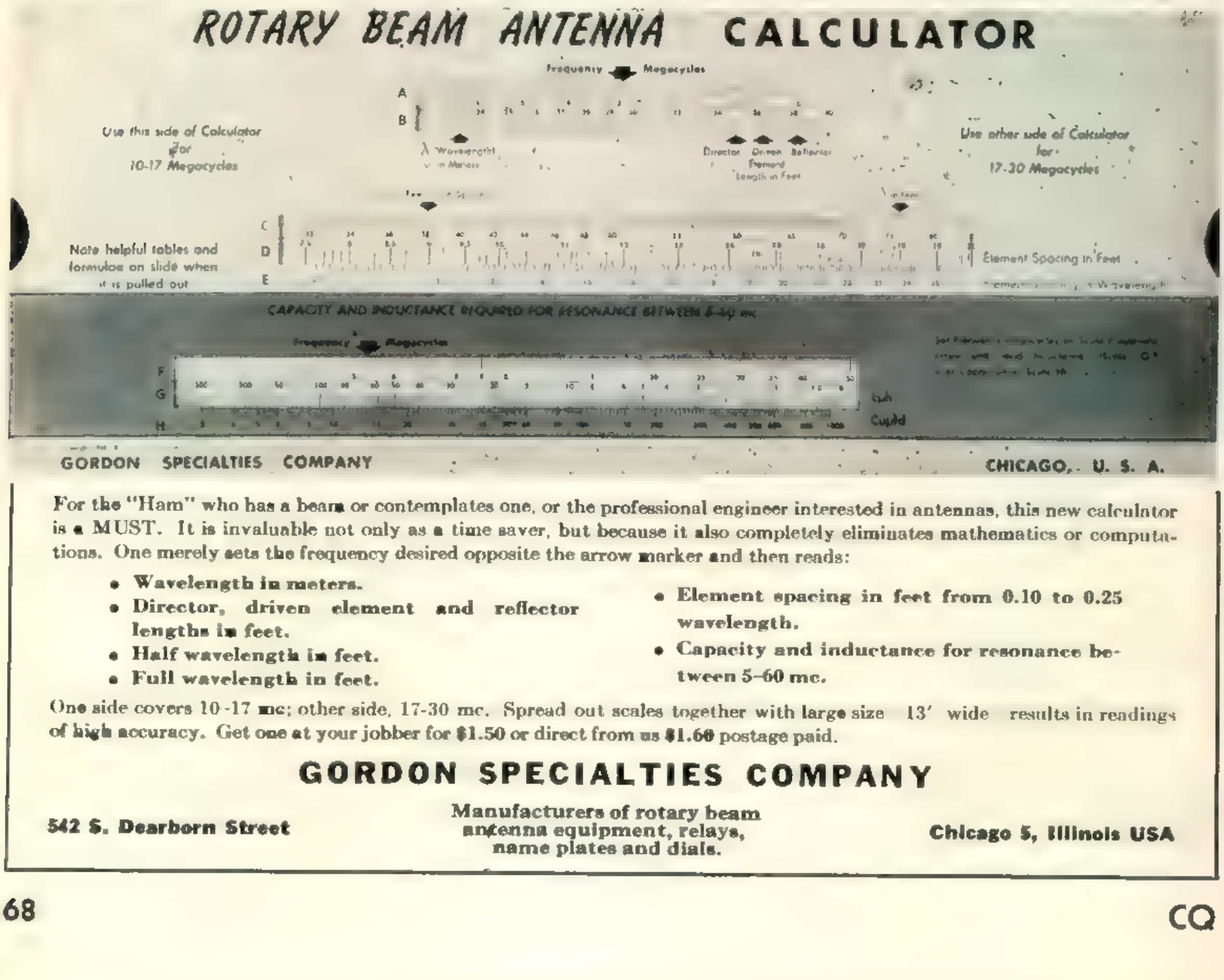
Zone 12

CE3AB	26	51

Zone 14

G3DO	33	86
F8DC	28	47

ROTARY BEAM ANTENNA CALCULATOR



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For the "Ham" who has a beam or contemplates one, or the professional engineer interested in antennas, this new calculator is a MUST. It is invaluable not only as a time saver, but because it also completely eliminates mathematics or computations. One merely sets the frequency desired opposite the arrow marker and then reads:

- Wavelength in meters.
- Director, driven element and reflector lengths in feet.
- Half wavelength in feet.
- Full wavelength in feet.
- Element spacing in feet from 0.10 to 0.25 wavelength.
- Capacity and inductance for resonance between 5–60 mc.

One side covers 10-17 mc; other side, 17-30 mc. Spread out scales together with large size 13′ wide results in readings of high accuracy. Get one at your jobber for $1.50 or direct from us $1.60 postage paid.

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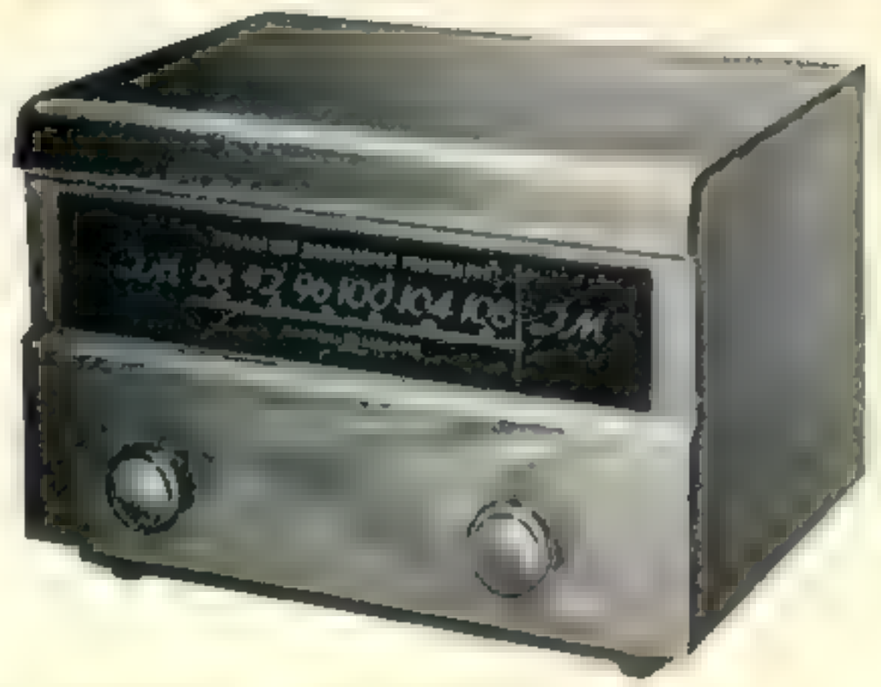
Chicago 5, Illinois USA

HARVEY has the latest!

TECH-MASTER Television Kit

Here is a **complete TV set in kit form.** RCA front end, pre-wired and aligned, 13 channels; all parts exactly as used in the 630TS; all hardware, punched chassis; complete set of 29 tubes including kine; RCA service manual containing all service data plus schematic and pictorial wiring diagrams of tuner and chassis.....**$198.50**

Harvey has all **TV components:** RCA coils and parts, Transvision kits, Vision Assembly kits, Telectron coils, Mallory Inducta tuners, RCA front ends, Essex RF power supplies and many others. Immediate delivery from stock, send your order for same day shipment.



FM Translator — GE Model XFM-1

FM Tuner covering 88-108 mc range, using guillotine tuning for highest efficiency, greatest stability. Designed for export, has input for 110 to 250 volts, 50/60 cycle. Not just another tuner but the finest FM translator you've ever heard. In walnut cabinet, complete with tubes,

HARVEY HAS IT **$49.50**

FM Converter for those sets in the old 40-50 mc band. Insert this compact converter between antenna and set.....**$6.00**

TV Trap eliminates unwanted signals. Has two ranges: 40-60 mc and 80-115 mc, both ranges may be used simultaneously. Easy to install and adjust.....**$6.00**

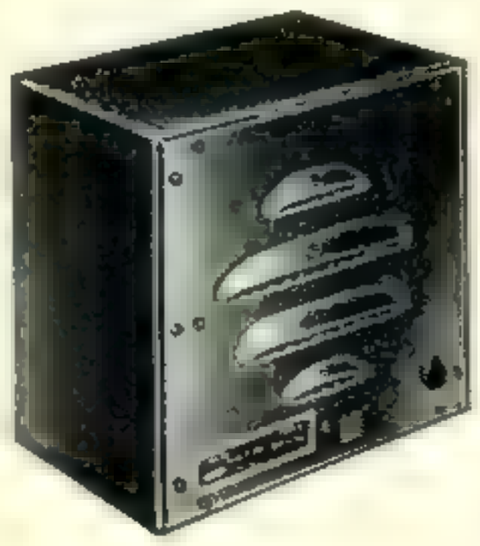
Type 1616 Tube: Half wave high vacuum rectifier. Filament 2.5 volts, 5 amps; peak inverse 5500 volts; peak current .8 amps; surge current 2.5 amps; average plate current .130 amps. **List Price $7.50. Harvey special price,** while they last.....**95¢**

Hammarlund FS-135C Frequency Standard — makes your receiver an accurate frequency standard with marker signals every 100 kc. Includes low-drift 100 kc crystal, 6AU6G tube, complete instructions. Supply limited. **Brand New** **$6.95**

Order one or more spare tubes, **6AU6G** .....**each 65¢**

Signal Corps Model LS-3 Speaker—6" PM in rugged, crackle finish steel case, complete with self-contained output transformer to match 4000 ohm load. Originally used with BC-312-314-348 receivers. Ideal for many uses around the shack. Speaker voice coil impedance 6-8 ohms.

Harvey Special . . $4.95



HARVEY'S HIT-OF-THE-MONTH

Crystals — You can't beat Harvey for crystals. Not off-frequency surplus but crystals right on your frequency, or within a few kc. 20-40-80 meter and 6 and 13 mc bands for only **$1.00**

Also in stock, a complete line of Bliley AX-2 & AX-3 crystals. When ordering crystals only, include 10¢ postage with your order. All crystals mounted in holder with ½" pin spacing, lucite adapter for 5 prong socket.....**35¢**

Telephone: LOngacre 3-1800

NOTE: All prices are Net, F.O.B. NYC and are subject to change without notice.

hrc HARVEY RADIO COMPANY INC.

103 West 43rd St., New York 18, N. Y.

Get Your Order In Early For Immediate Delivery.

but in order to avoid more confusion, let's refrain from counting YA3B until someone actually receives a card. WØSQO says that his card to YA1A, addressed to the P.O. at Kabul was returned. That does it.

The station signing *ZD2K* on or about April 19, 1947, was prewar G3RR, and is now signing *ZD2KC*. Unfortunately, however, both ZD2K, ZD2KC and also ZD2G have been bootlegged since then, according to G2PL, via 6VFR. He's sure full of info this time. W6ODD, who gave us the sad news that *ZD1WB* was NG, now has some good news to offset this. Here 'tis. . . . From approximately July 15th to August 15th he will be on the air in Saigon, French Indo China, authorities willing, and will sign *W6ODD/FI8*. Bill will use 100 watts, v.f.o., and camp near 14050 kc. All QSL cards via A.R.R.L.

Before I forget it, Herb, in connection with this pirate business, there's something that has been knawing at us for some time. In addition to the established pirates that we've been scratching from time to time, we've accumulated quite a bunch of very shaky, suspicious characters. These rare-prefix jockeys are in a class by themselves. We don't have sufficient information to definitely class them as good or bad, and yet, only a few of the DX gang as a whole have worked any one of them. They get on the air a few times, they never QSL to anyone, and no one ever seems to hear from them again. Most of these appeared a year or so ago. Let's publish a list of them, and unless some of the gang send in information which will definitely establish them as legitimate, let's scratch 'em off as of December 31, 1948, and start off the new year on a basis more equitable for all. The ones we are dubious of are these: *EA7A* (claimed to be Rio de Oro), *ZA2A*, *ZA2D*, *ZA2X*, *FG8D*, *FP8A*, *PX1B*, *CR8AC*, *FL8AE*, *F8LAM*, *FR3CE*, *ZD1WB*, *YI7BZ*, *FB3AC*, *PX2LD* (Monaco), *TA1AD* *ZC4C* *VS9AU* (claimed to be Maldive Is.), and *FB8AC* (some claim Madagascar and one as Comoro Is.). On a few of these, the worst appearing, we have temporarily withheld credit pending investigation, but as you know, the investigations have not helped them thus far. Don't you think this would be fair for all concerned, or will it cost you a country, too? Let's suggest it anyway and see how the gang feels about it.

Joao Carlos Chaves, CR6AI.

By the way, Herb OB, a guy straggled into your office the other day while I was there keeping an eye(?) on Betty. This guy, in a loud voice, almost a yell, says, "Where's Becker?" I answered as politely as possible, and told him that you had gone to Chicago for a few weeks, to which he says, even louder, "What for?" Not knowing too well myself, I tried to explain that I thought it was for some kind of show, or something. That did it. He comes back S9 plus and about T4 with "OH, YEAH? I knew the guy was slippin, but I didn't think he would go all the way to Chi to work a W9." Whereupon he made a quick and dirty exit. What nice people you know. At first we were inclined to pass it off as a chance remark from a crackpot, but lately we have begun to wonder. Now honestly, Herb, why did you go to Chicago?

(*QSY to page 72*)

ASK THE HAM WHO WORKS ONE...

BABCOCK DX'ER

MINIATURE TUBES
6AU6 - 6J6 - VR150

NOT A BROAD BAND DEVICE

This Pre-Selector unit *brings in* stations you've never heard on your receiver.

GAIN *revolutionary reception*
IMAGE REJECTION *almost infinite*
SIGNAL TO NOISE RATIO...
Will improve any receiver
4 BANDS 10 - 11 - 15 and 20 meters
plus general coverage-13-40 m.c.

A 2 to 7 "S" UNIT BOOST TO DX
HAM NET... $27.50

DELIVERY CHARGES PREPAID
BULLETIN ON REQUEST

At LEADING DEALERS or

BABCOCK RADIO ENGINEERING, INC.
6164 Sepulveda Boulevard • Van Nuys, California • U.S.A.

Wonderful NEW 3/4 RPM Motor $2.95

Ideal for a beam rotor, plenty of power. Originally designed for 24 volt DC operation, but easily converted, 110 volts AC. Complete instructions included. Excellent for other uses too. Brand new, surplus, guaranteed

(Add 40c each to cover postage and handling)

PLUS

24 Other Bargains!!!

"Meter Specials"

77¢

Brand new [redacted], 3-0-3, DC voltmeter 2" round case. Meter has 450 ohms resistance (150 ohms per volt). (Add 15c each to cover postage and handling)

Brand new Bowers D.C. Volt meter 0 to 9 volts in 2" case with 2 3/4" Flange ..... each .99c

Brand new Bowers D.C. Anmeter 0 to 100 amp scales (600 ma. movement with 100 amp shunt) same case as volt meter each 99c

Add 20c each to cover postage and handling

Stock Up

WILLARD 2 VOLT BATTERIES ONLY $1.25 ea.

500' $2.95 3 CONDUCTOR TELEPHONE WIRE

3 conductor Braided insulated copper & steel telephone wire. It is made of copper for conductivity, and steel for strength. Worth at least 3c per ft. Yet due to an exceptional buy, we can now offer it at less than 1c a ft.

Shipped Express Collect

Radio Compass

Now $14.95

RS/ARN7 or 433G, either of these Radio Compass Receivers complete with tubes. Ideal for conversion for home reception. Used but good. A real buy at only $[redacted]

(Shipped express collect)

Tubes!

3 CP 1 (Ind. Screen)	95
3 DP 1-A (Ind Screen)	.95
3 FP 7 A	1 35
3 HP 7	1 45

add 25c each to cover postage and handling

5 FP 7	1 75
5 CP 1	1 95
5 BP 1	2 45
5 HP 1	2 45

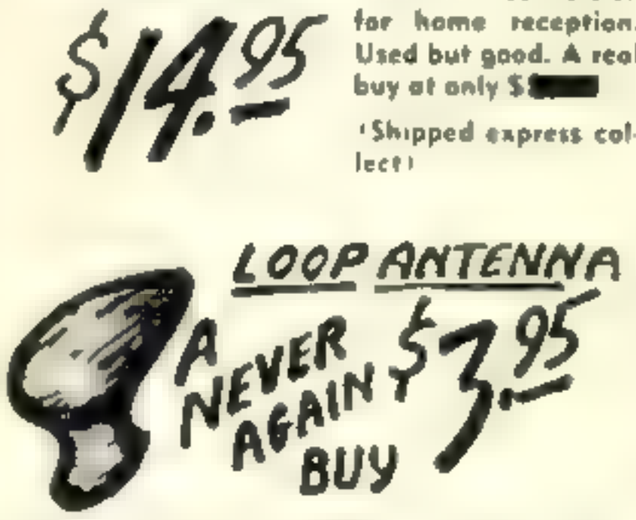
(add 35c each to cover postage and handling)

7 BP 7	2 65
7 CP 1	3 25

(add 40c each to cover postage and handling)

9 GP 7	3 50

(Shipped express, charges collect).



LOOP ANTENNA A NEVER AGAIN BUY $3.95

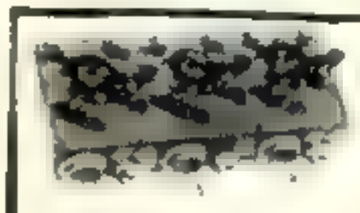
Used primarily on aircraft & Marine ADF Systems, Loop LP-21-A contains an electric motor and selsyn. These loops have been removed from salvage aircraft, but are guaranteed to be in excellent working condition.

Shipped Express Collect

1300' Rubber Covered Wire

ONLY $18.00

New 4 conductor 16 gauge rubber covered cable. Color coded. Used by United States Government as Field Telephone Cable. 1300 feet on steel reel F.O.B. Our warehouse. Shipped motor freight or express shipping charges collect.



BC 450 CONTROL BOX

Triple remote control box for Command Receivers (SCR 274 N Series) Equipped with 3 tuning dials, 3 volume controls, and 6 selector switches. Used but in excellent condition, a steal at only $1.50 ea. (Add 25c to cover postage and handling.)

PHANTOM ANTENNA 85¢

A transmitting antenna, for use on approximately 450 MC. Complete with standard coax connector. A weatherproof unit. (Add 25c to cover handling and postage)

ZA-1 LOCALIZER SIGNAL CONVERTER

CDE-20109 ONLY $1.95

Contains 2 tubes 6F8G and 6C8G, several carbon resistors, 2 wire wound resistors, 2 precision resistors, 3 transformers, 3 set volume controls and other valuable parts. Add 40c to cover handling and postage.

CHECK THESE VALUES

Continuity Tester with 12 extra penn light cells..... $1.95
Add 15c to cover handling & postage

Throat Mike, complete with cord and switch..... $ .95
Add 15c to cover handling & postage

NOTE Due to customs regulations which require excessive paperwork and packaging complications, we cannot accept orders for shipment outside the United States or its possessions.

IMPORTANT! All merchandise subject to prior sale, minimum order $2.00, No C.O.D. orders accepted. Michigan residents must add 3% State sales tax.

N. SILVERSTINE CO.

6532 EAST McNICHOLS ROAD DETROIT 12, MICHIGAN

"Seven Acres of Surplus"

OK1AW again reports, this time with 39 and 118. Alois says he has now worked all 40 zones, having just worked *C6ATE* in Sian, China, who insisted he was in Zone 23. I'm afraid Alois had better sharpen up his tubes and keep plugging, because Sian (Siking) is in Shensi Province which is still in Zone 24, unless they've had some pretty bad earthquakes over there, and shifted things about a bit. He also wants to know if *TA3SO* is genuine because he can not get his card. Yes, he's genuine all right. How about giving WØSO the needle, Herb, I want his card, too. PY1DH sends along another VFB letter. He is perhaps the most eager beaver for DX in all of South America, and is still trying to get us to add a few more countries to the Official List. Ed's motto seems to be, if you can't work any new ones, then try to make some out of what you already have. However, he doesn't appear to be having any difficulty in working them, and is now up to 39 and 152. He was having a great time in the USSR contest, and was well on his way toward working all Russian Republics, when along comes W2YFB with an urgent QSP for Chile. This stopped a one-man battle with the USSR. The last we heard was that he had become a 50-mc man, so perhaps this will be his downfall. No, I guess not. I see where he says that *ZD9AA* has now moved the band-balancing to the low end of 14 mc, and that he is sure to get him because he is on the wolf pack, too. It must be universal. W6SN is still in there buzzin, and I do mean buzzin, but in spite of this, has managed to climb up to 39 and 165. Bill is another one waiting for a card from Zone 19 to end it all. He works his DX the hard way with a not too good antenna setup, but hopes to get a 3-element beam up in the air in the near future, and then either relax a bit, or retire. He hasn't decided which yet. Thought I heard W6ITA on 'phone the other night, and was sure surprised because I thought he was still in Chicago. However, the mystery was soon solved when I discovered the Easterly window was open, and a little breeze had come up. Do you suppose this is why the DX stations tell him "no change" when he QRPs? Maybe that's what you have to do to work 'em on 'phone. I wouldn't know.

A letter from an old friend *FB8AB* emphasizes the difficulty a lot of the gang are having in getting back on the air. Paul is in need of quite a bit of gear destroyed during the war and unobtainable through local supply sources. He doesn't say specifically what he is missing, but airmail service is good and if the gang want to see him fired up they might drop a note to F. Paul Bour, FB8AB, Tananarive, Madagascar.

Up Portland way, W7FZA is taking up auto racing in place of ham radio, much to his XYL's alarm. With W7BD owning and driving a couple of midget racers, Dick now has the bug, and so is practically leaving us with a total of 40 and 166. It's been nice knowing Dick, and we hope he returns without a crippled fist.

WØDU suggests that it might be helpful to those with limited time to know what time WØs are

1948 DX Marathon

CQ is sponsoring a DX Marathon for the year 1948. The purpose of the DX Marathon is to revive some of the interest that has been lost during the terrific last two years of DX. The rules governing the DX Marathon appeared in May CQ on page 74.

Something NEW and Different.....

LOOP LP-21
RADIO COMPASS INDICATOR ANTENNA
Can be used for small beam rotator. Loop rotated by selsyn motor, also has selsyn indicator trans. for remote indication. Slip ring assy. (3). Contacts and rings made of silver. Loop enclosed in tear drop housing. Wiring diagram for AC operation is included. Used, but tested **$3.95**

ALUMINUM TUBING for Antennas

1-1/4"	Dia.	.058 wall ..	**.20** per ft.
2"	Dia.	.049 wall	**.20** per ft.
1/2"	Dia	(1/2")	**.13** per ft.
5/8"	Dia.	(Telescopes 5/8")	**.14** per ft.

Sold in lengths of 12 feet only.
GUY WIRE, Stainless Steel, Stranded 3032".....**.02** per ft.

WALKIE — TALKIE BC-222
Frequency Range 28 to 52 Mc. Portable Radiotelephone transmits and receives anywhere in the 28 to 52 Mc. Bank which includes 6 and 10 meters. Realy to operate. Complete with Handset, Tubes, Schematic, Antenna, and Batteries. Checked before shipped Reconditioned by Govt. and Guaranteed.....**$39.50**
NEW Guaranteed.....**$49.50**

SELSYN INDICATOR AND MOTOR
Part of LP-21 Loop. 0-360 calibration on selsyn. Wiring schematic included. Used (tested).....**$2.95**

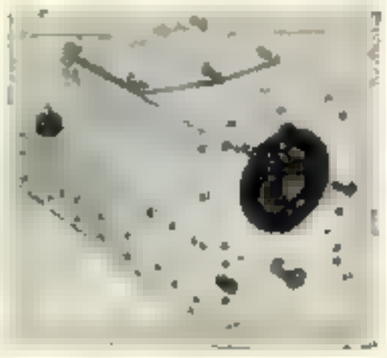
I-82 5" INDICATOR
Radio compass indicator used with selsyns for remote indication. Used (tested) at **$2.95**
New at.....**$4.95**

DYNAMOTORS

MOBILE USE — 9 Volt input; Output 405 volts 95 MA. Also will operate from 6 Volt input; Output 280 volts 95 MA. Size: 3" x 7". DM 635x **$3.95**

BC 221A* FREQUENCY METERS (* Later Models) CRYSTAL CALIBRATED
Can be used as signal generator and V.F.O. Crystal calibration. Ranges: 125 K.C. to 20,000 K.C. Complete with Tubes, Crystal, Original Calibration Charts. Every meter tested and guaranteed. Slightly used, but in excellent condition. Stock No. EN 4221 — Price: **$39.50**

COMMAND RECEIVER COMP.
BC 454—3-6 Mc. With schematic. New .**$5.95**
Dual Receiver Rack New **$1.00**
Tuning Control Knobs **.50**



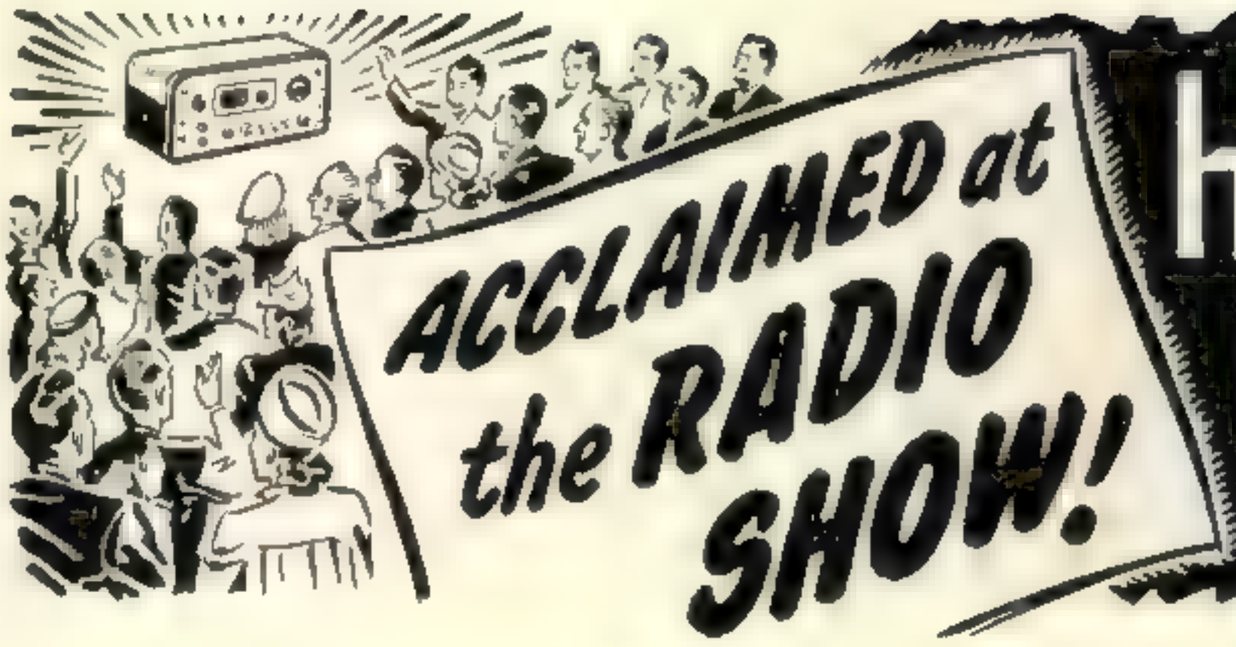
MG-149F INVERTER
Used to operate Radio Compasses. Input 24 volt DC; Output 26 volts 400 cycle 250 VA or 115 volt 500 VA, 400 cyce. Used, reconditioned and tested.....**$9.95**

SELSYN 2J1G1
Suggested wiring for 110 volt, 60 cycle included. Normally operates from 57-1/2 volts, 400 cycle Used (tested) Only **$3.50** per pair.

CLOSE-OUT SPECIALS
BC-778 Gibson Girl, Trans. only. Like New.. **$5.95**
BC-456 Comm. Trans. Modulator. New.....**$2.50**
TG-10 Keyers w/tubes. Used, tested **$18.50**

MINIMUM ORDER — **$2.00**
Prices: F. O. B., Lima, Ohio — 25% Deposit on C. O. D. Orders

FAIR RADIO SALES - 223 S. Main St. - LIMA, OHIO



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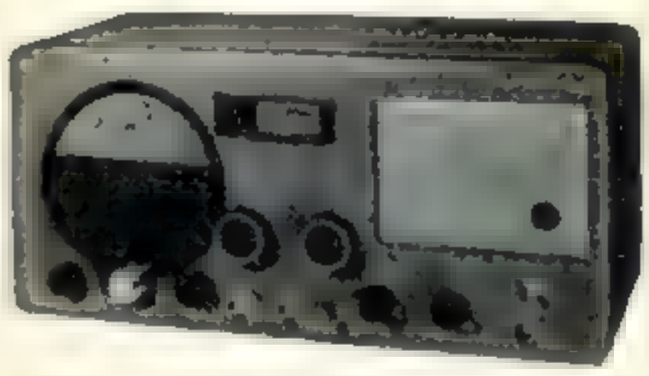
Latest 1948 Models Brought to You *Direct by Mail by* Concord



S-52 AC/DC RECEIVER

AC/DC model of the popular S40A. 4 Bands, from 540 KC to 43 MC. Operates from 117 Volts AC/DC or with interchangeable ballast from 230 Volts AC/DC. Internal PM dynamic speaker held in rubber shock mounts. 7 tubes plus rectifier and ballast. Cabinet 18½" x 8½" x 9-⅝". Overall 18½" x 9" x 11" deep. **Model S-52, ONLY $99.50.** Order AD4-No. 21087.

S-55 & S-56 FM, AM RECEIVERS

High quality AM-FM reception. Housed in gray steel, satin finished, metal cabinet. S-56 is same receiver without cabinet. 10 tubes plus rectifier. 2 bands, 540 KC to 1700 KC and 88 MC to 108 MC. Speaker output 500 ohms. Input 105-125 volts. 50/60 cycles. 90 watts. S-55: 18½" wide, 8-⅞" high, 12" deep (13" deep overall) S-56, 12½" wide, 7⅛" high, 8¾" deep (11" deep overall). **S-55 ONLY $129.50.** Order AD4-#21088. **S-56 ONLY $110.00.** Order AD4-#21089.

ORDER NOW-items listed below delivered Sept. 1948

Prompt ACTION Assures FIRST DELIVERY...

S-58 FM . . . AM RECEIVER

Provides AC-DC operation and AM-FM reception in one compact unit. 6 tubes plus rectifier. Phono connection. AM coverage — 540 to 1600 KC, FM coverage — 88 to 108 MC. Power consumption—30 watts 105-125 V 50-60 cycles AC or 105-125 v DC Overall size: Length 13¼", depth 6", height 5½". **Model S-58, ONLY $59.50.** Order AD4-#21082.

HT-19 . . . AM . . . FM TRANSMITTER

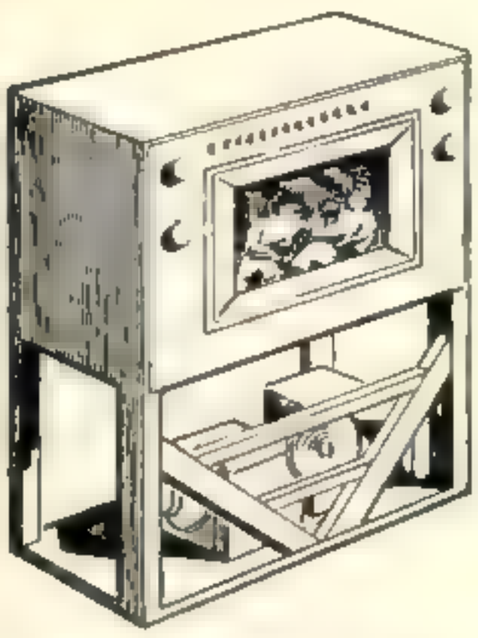
Completely self contained requires only a microphone or key, antenna, and source of AC power to go on the air. 10 Tubes including rectifiers, 5 amateur bands. Built-in preamplifier for high impedance crystal or dynamic microphones. FM audio distortion measured on AM receiver under 5%. Less on FM receiver. Temperature compensation and voltage regulation insures negligible drift. Single tuning for all amateur bands. Designed for operation from 105-125 Volts 50/60 Cycle alternating current source. Only 20" wide by 10¼" high by 18" deep, overall. **Model HT-19 ONLY $298.00.** Order AD4-#11347.

SX-62 FM . . . AM . . . CW

Has slide rule dial with foreign short wave stations and all services. 500 k c. crystal calibrator; pointer adjustment to set receiver on exact frequency; single knob tuning with approximately 60 to 1 tuning ratio. Continuous frequency range. 540 kilocycles to 110 megacycles in 6 bands 4-position switch selects mode of operation. PHONO, FM, AM, or CW. 4-position tone control provides LOW, MED HI, FI and BASS. 6 position selectivity switch with crystal filter. **SX-62, ONLY $269.50** Order AD4-#21079.

S-59 FM . . . AM RECEIVER

A NEW type chassis for custom installations. 7 tubes plus rectifier. Phono connection. AM coverage—540 to 1600 KC. FM coverage — 88 to 108 MC. Continuously variable tone control. Power consumption—60 watts 105-125 V. 50-60 cycles AC. 500 ohm output transformer Chassis size! 12⅝" x 5⅛". Overall size! Length 13¼", Depth 6", Height 5½". **S-59,** with loop, less speaker only **$49.50.** Order AD4-#21103



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MODEL T-60 192 Square Inches of bright, flat, sharp television image. No need to dim room or lights. With Hallicrafters NEW Television system you get a 16" x 12" image from a 1.4" x 1.86" picture on the face of a new 2½" magnetic projection triode. Complete with projection box enclosing optical system; lenses, mirror and rack. 25kv high voltage element, and receiver chassis. Order the **T-60—Priced at $595.00.** Order AD4-#21051.

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working stuff like VU, VS, HS, PK, etc., which apparently are not on when he is. How about some of the Zero Quartet letting Ray know about this? If *they* don't know, nobody does. Dick, W8VLK, doesn't expect to do much DXing for the next few months. A new home in Grafton, Ohio, is putting the skids under him, so he will temporarily rest with 38 and 112. F8DC expresses the opinion of many when he says that the French DX men are much concerned over the proposal to extend the American phone band on 20. They can see very little chance for anyone to work DX through the resultant bedlam this proposal could bring.

The Committee is getting alone fine with no one here to crack the whip or focus an eagle eye on their work. We had a meeting the other evening, and didn't get down to business 'til midnight. Why don't you open a branch in Chicago and manage it? Well, Herb, that's about all the goop from here. Hope there's enough for you to dream up a column this time, but if not, Larry could reprint last July's, and maybe no one would notice it. Incidentally, don't think for an instant that I, too, am wistfully dreaming of QSOs with W9s. Such is not the case. Confidentially, I'm working night and day on a gimmick that will make W2GWE's xmitter sign W6ENV. I gotta work some of that stuff through the East Coast in the late afternoons.73

Andy, W6ENV

DX QTHs

AC3NC, P. O. Gangtock, Sikkim State
C8LS, Box 409, Shanghai, China
CR6AQ, Box 79, Luanda, Angola
CR6AR, Box 147, Benguela, Angola
CR6AN, Box 51, Lubango, Angola
EA3ZT, Mario Flaque, 268 Aragon St., Barcelona
EK1GW, Glen Ward, c/o Mackay Radio, Tangier Zone, Morocco
EK1TF, Herb Plummer, P.P.O. Box 57, Tangier Zone, Morocco
FK8AB, John Duplap, Noumea, New Caledonio
HA (all stns.), A. Sass, Budapest, Dohany-u. 1/c, Hungary
LJ2K, Trondheim Navigation School, Trondheim, Nor.
MB9AG (new QTH), C. 12 Broadcasting Station, British Forces Network, Klagenfurt, Austria
PK5HL, D. G. Veltcamp Helbach, Oranjeplein 4, Bandjermasin, South Borneo, Indonesia
PK6XA, Lt. Bert Krygsman, c/o N.N.G.P.M., Morotai Is., Moluccas, Neth. East Indies
PX1A, Via: Box 273, Chihuhua, Mexico
PZ1FB, Miss Gloria Van Bek, Box 109, Paramarimo, Neth. Guiana
VR2AR, J. T. Whin, Lauthala Bay, Fiji
VR6AB, Gilbert Long, Swan Hotel, Horsham, Sussex, England
YN1EP, Norman Fontaine, 153 AACS Squad., APO 3824, P.M. New Orleans
YS1RM, P.O. Box 339, El Salvador
YS1V, Bill Calderon, Inalambrica, San Jacito, El Salvador
ZC1CL, Dan Lockyer, c/o R.A.F., Amman, Trans-Jordan
ZD1LQ, Lungi Airport, Freetowd, Sierre Leone
ZD2RGY, Nigeria Signal Squadron, Lagos, Nigeria
ZD9AA, Box 4887, Johannesburg, Union of So. Africa

V. H. F. - U. H. F.

(*from page 49*)

Their methods were laboratory methods which when properly evaluated show exactly what to expect from various types of locations using either polarization. Basically, they found nothing to favor one over the other, except that certain paths in the U.S. seemed to favor one method, while another

144 MC Honor Roll

	States	Districts			States	Districts	
W1IZY	12	4	VE1	W8QKI	7	4	VE3
W1IPV	11	4	VE1	W8PYY	7	4	
W3GV	8	5	VE3	W3RUE	5	3	VE3
W1JFF	11	4		WØWGZ	4	4	
W9ZHB	9	6		WØDDX	2	1	
W9LWE	8	5		WØMZH	2	1	
W9IPO	8	5		WØRNC	2	1	
W9BBU	8	5		WØZJB	2	1	
W3GKP	8	4					

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- Hams everywhere specify KENYON "T" Line Transformers! Manufactured under rigid standards, all KENYON transformers are constructed of the finest grades of material plus the skill and long experience of a highly trained competent operating staff.
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location showed the other slightly better. These investigations are now available, and within a short time *CQ* will present them in a very interesting article.

50-mc Openings

With the opening of 6 meters it is only fitting that we go into what the gang worked.

April 20: WØKPQ worked on aurora; WØCJS and heard WØBJV, USI, YSJ, VZP, HAQ. Heard in the Belleville, Ontario, area were. W8GYT, GTT, W9PK, W9ZUL, between 2000-2300 EST.

April 21: W9ALU worked WØQIN on aurora, at 2300 EST. W7DYD QSOd W7FIV and was heard by W7FLQ.

April 22: VE3ANY worked W2AMJ, BYM, W9PK on aurora, while VE3APF hooked W9PK.

May 1: This brought the start of the Es season for a fairly well spread opening.

W9ALU in Ill. worked, between 1354-2034 CST, the following: W5VY, LIV, KSW, W9IKI 5, W5JLY, W5AJG, FSC, EEX, EYV, IGL. W5AJG in Dallas with the XYL (W5JKM) at the mike made contacts with: W8LHV, W9HGE, QUV, FJB, QKM, ALU, PK, ZHB, ZBK, THL, GYX, UNS between 2028-2230 CST. W8QYD hooked W5LBG, VY and W5JLY from 2127-2202 EST. WØKPQ made it with W5DXB, JLY, IOP, hearing W5LIV, UB, ML between 1920-1910 CST. W4EID had a nice long contact with W5HF in Amarillo starting at 1930 EST. W4GYP worked, between 1943-2013 EST, W5HF, BEA, WX, and a long one with W6IWS for the first double-hop Es reported in May. W5JLY rolled up these: W8QYD, NZ, W9ALU, BIQ, SVF, ZBK, FHR, AB, OLN, PK, ZHL, NPN, UNS, GYX, KKT, WØKQM, DZM, KPQ, all between 1809-2056 CST. W5HLD in Okla. heard his first Es when some W4s came in but they did not look for his c.w.; he did work W8NQD, W8DLY and W5JTI.

May 2: W5JLY hooked, between 1040-1124 CST, WAOW, W6OB, W6UXN and W6ANN. W5AJG worked W6UXN, W6AOR, between 1130-1145 CST. W6UXN made it with: W5BUZ, W5JLY, W5LBG, W5HF, W5LIV, W5AJ, W5HLD, W5HTZ, W7FFE and W7FDJ, between 1000-1505 PDT. W7QLZ worked, between 1300-2010 MST, W6VWK, OVK, UOV, VEV, VNH, CAN, DIX, W5LBM, JL, W7MWQ, FDJ, FFE. W7MWQ made it with the same gang as W7QLZ. W5JLY QSOd W6BWG, NAW and W7QLZ from 1135-2015 CST. W7QAP with his 15 watter had contacts with W6OVK, UOV, and heard harmonics up to 53.5 mc, from 1315-1405 MST.

May 6: VE3ANY worked W5AJG at 1130 EST. W9ALU had contacts with W5IOP, AJG, ML and W5ZZF, between 0827-0852 CST. W5AJG QSOd W8QYI, W4RBK, W9TSS, ALU, VPN and VE3ANY, from 0800-1000 CST.

May 8: WØKPQ made it with W2PWP, W1DJ and VE3AJS from 1020-1120 CST. W9ALU heard W2BYM at 1027 CST.

May 9: W4EID hooked, between 0955-1300 EST: W1BWJ, AF, EKT, CGY, PNB, CK, LSN, W2LAL, RLV, RIS, W5IVU, VE3AXT, ANY, ARV, KM, AFE. WØKPQ had QSOs with W2GYV, W3CIR/1, W1LLL, and heard W2CK, LSN, EIO, VE2OS, JJ, ABT KY, from 1040-1200 CST. W9ALU worked W2BYM at 1135 CST. W4JEP worked W2AMJ, W1CK, W5JTI, FSC, LIV and W9ZHB from 0950-1505 EST. W4GYO made it with; W1JCL, AEP, CJL, KHL, W3CIR/1, W2AMJ, BYM, IDZ, COT, VE2KH, RLV, RIS and VE3SB, from 0940-1145 EST. Ferrell in Phila heard: W4NEE, EID, GJO, GMP, DJZ, W8DLV, W9JMS, AQQ/9, VPN, W8ZVY, WØIFB, W9PK, FHR, QV, AEN, ZHB, between 1027-1252 EST.

May 10: Heard in the Boston area were stations from St. Paul, WØNFM and W9QUV. W5AJG worked W9HGE, PK, W8CWQ, AGA and WØYSJ, from 1629-1900 CST. W9ALU made it with W2LAL, W2MEU, W2BYM, W5WX, W5HF, W5LIU from 1925-2022 CST. WØKPQ had contacts with W5LIU, W5JLY and heard W5VY, 5ZZF, 5FSC, 5ML, 5JTI and W4EQR. W7QAP at work heard W5EQR, W5JTI, 5FSC, 5EEX, 5IL from 1835-1930 MST. W7HEA had his first opening and worked WØUSI, ØBJV, ØDZM, ØIFB, ØYSJ and ØKPQ from 2058-2230 PST.

May 11: W4GYO hooked W1IN, 1AF, 1RO, 1GJZ, 1HDQ, 1DJ and 3CIR/1 from 2000-2033 EST. WØKPQ reports an early morning QSO with W7SP at 0030 CST which was probably a hangover from the day before.

May 12: W7QLZ worked W5LEI, 5GNQ, 5AEN, 5CIX and heard two WØ signals around 1930 MST.

May 13: Was a long opening but somehow lacking activity in the right spots at the right time. Ferrell reports the band opening at 0937 and not closing until 2130 EST. Heard during this period were: W4EQR, 4LMB, 4CNK, 4EQM, W5JTI, W9OLN, 9ALU, 9VPN, 9QCY, 9ZHB, 9BHH, 9HGE, 9QKN, 9QUV, WØIFW, ØKPQ, ØCJS, ØBJV, and ØQIN. WØZJB/1 heard W9FHR and 9QKN in the Boston area.

May 16: WAZJB/1 heard W5JTI and W5NLP between 2000-2100 EST. W7HEA had his second opening and worked WØDZM, ØKPQ, ØYSJ, ØAZE and ØCJS between 2115 and 2145 PST.

May 19: Short scattered opening with WØYUQ working W2BYM and W2PWP. This around 1940 EST.

May 20: Band was apparently open, although no reports have been received. Ferrell heard W9HGE call CQ several times, but work no one.

May 22: Contest week-end opened with severe ionosphere

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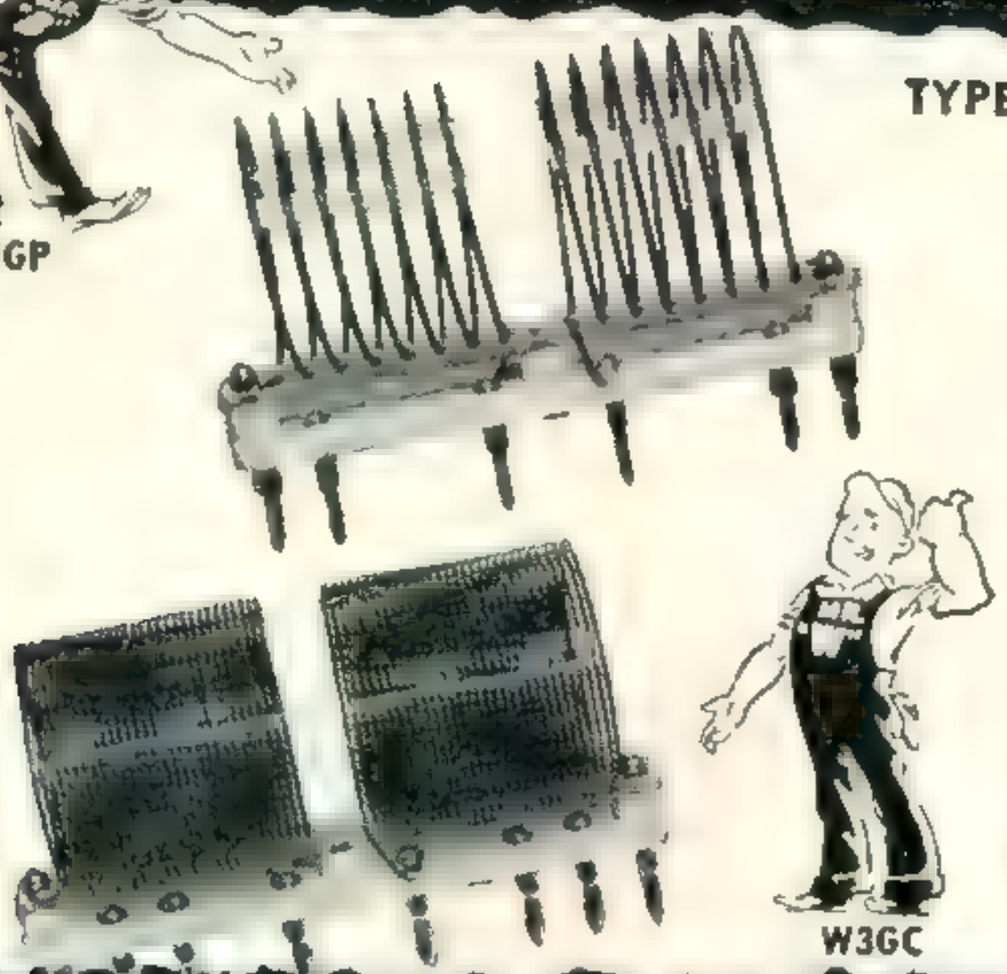

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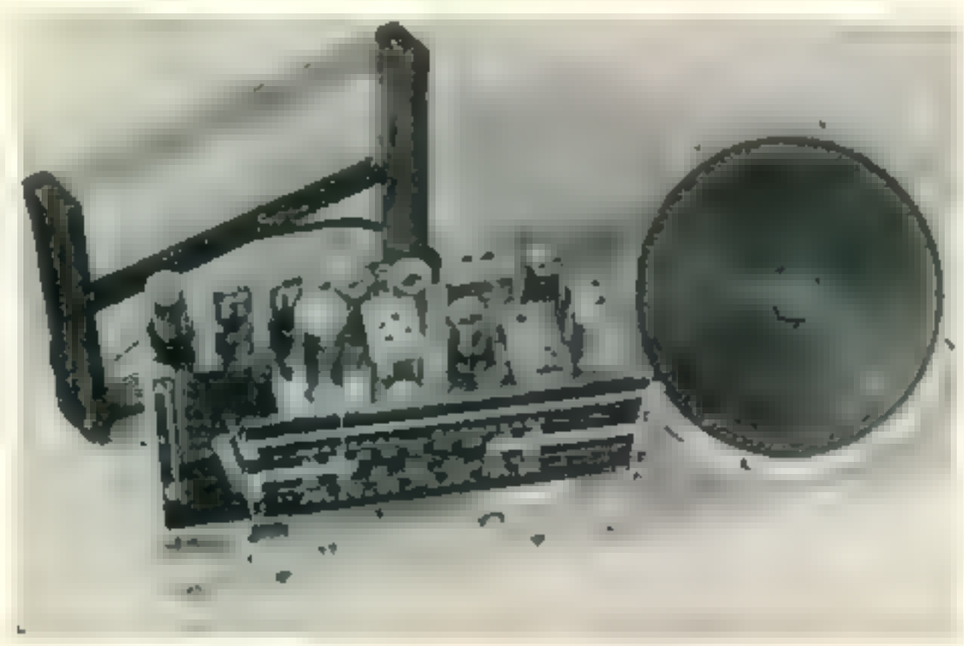

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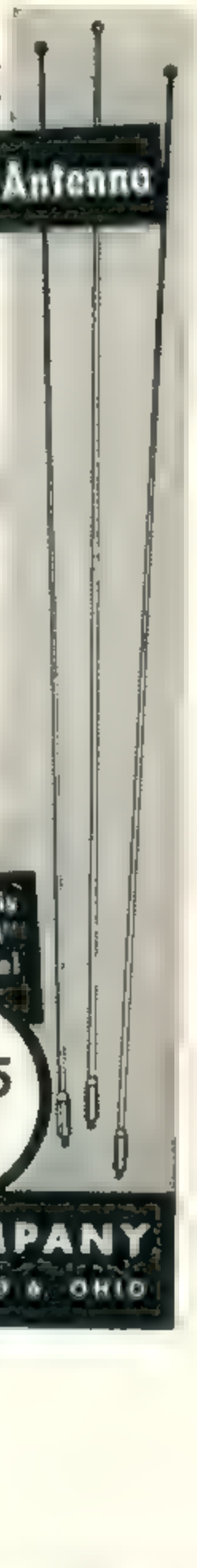

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storm. However, W3CGV pulled a corn out of the fire by working W8SFG on aurora. W2AMJ worked W8QYI during this very short opening.

144-mc Notes

W4FMW will be operating on one of the local mountain tops, during the A.R.R.L. Field Day in June. He would like the 144-mc gang to look his way for he will have a stacked antenna, and from a mountain top anything could happen. W4MFW mentions that W4LNB in Chattanooga, W4KPQ in Bremen, and quite a gang in Atlanta are active on 144 mc.

Naturally with all this "early morning stuff" on 144 mc for the Texans, they are up in the air about 2, so let's look into the matter and stations involved.

April 28, W5AJG in Dallas worked W5DAA in Kingsville and W5JKB, both a distance of 375 miles, from 0600-0800 CST, when signals started to flutter out. Prior to this on the 26th W5JLY in San Antonio worked W5FSC and W5KFD in the Houston area, about 300 miles, from 2147-2247 CST, for the first night work. April 27, W5JLY worked W5JKB and W5DAA in Kingsville, about 250 miles, reporting the signals averaging an S6. The time was 0025 and 0026 CST, again in the evening. W5JLY uses a 522 with 20 watts, feeding a vertical 5-element beam.

May 2, was a corker for W5AJG, for the word of the previous contacts had spread like wildfire through Texas, so from 0600-1000 CST he worked the following: W5EA1, FSC, IYF, BHO GLS, all in the Houston area at 300 miles; W5JJG, La Porte, 315 miles; W5ATW Waco, 100 miles; W5VY and W5LIV in San Antonio, at 350 miles; W5SM and W5AVW in Beaumont, at 350 miles; W5DDJ in Galveston, at 350 miles and W5DAA in Kingsville, at 400 miles. During the QSO with W5FSC, both stations switched to 6 meters, where their power was much greater and for which they had better antennas, but the 2-meter signals were stronger. Ironical as it may seem, W5LAR in Ft. Worth was on but did not hear any of the stations, although he is only 40 miles from W5AJG. Looks as if it won't be long until that record is in the "solid vertical" south.

During the times that the 2-meter band was open for these contacts, W4GJO in Orlando, Fla., advises that the Orlando FM station on 100 mc was being heard all over the south and into Texas. With that over-water path from Fla. to Tex., the "Yankee" boys are becoming jittery about their DX record.

W5SM in Beaumont has a 5-element horizontal beam and a 16-element vertical. Using the vertical he can work into Houston or Galveston almost constantly, yet the horizontal is much weaker at W5NZX, whose 16-element array is a flop-over type to either polarization. W5SM runs 125 watts to an 829 final and VHF-152A. He would like the Mobile, Ala., gang to look his way, for he has been hearing the FM station there quite regularly. Operating hours at W5SM are from 0600-0630 and special listening time is from 2100-2130 CST as well as the early morning time.

Here's some real DX for the Texans to shoot at, for XE1QE in Mexico City has 90 watts to an 829B on 145 mc, feeding a 6-element stacked array that is vertically polarized, and a VHF-152A. On April 8, at 1822 CST, XE1QE worked XE1KE and XE1IT for the first XE contacts on 144 mc. Anyone interested in skeds, may write XE1QE, Apartado 1980, Mexico City, D. F.

W8WXV, in Shiloh, Ohio, uses a corner reflector, and 75 watts to an 829B. The receiver uses two

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The square wave is of excellent shape between 100 and 5,000 cycles giving adequate range for all audio, FM and television amplifier testing.

Either sine or square waves available instantly at a toggle switch. Approximately 25V of sine AC available at 50,000 ohm output impedance. Output +1 db. from 20 to 20,000 cycles. Nothing else to buy. All metal parts are punched, formed and cadmium plated Complete with tubes, all parts, detailed blueprints and instructions.

HEATHKIT SIGNAL TRACER KIT

Reduces service time and greatly increases profits of any service shop. Uses crystal diode to follow signal from antenna to speaker Locates faults immediately Internal amplifier available for speaker testing and internal speaker available for amplifier testing Connection for VTVM on panel allows visual tracing and gain measurements Also tests phonograph pickups, microphones, PA systems, etc. Frequency range to 200 Mc. Complete ready to assemble. 110V 60 cycle transformer operated. Supplied with 3 tubes, diode probe, 2 color panel, all other parts. Easy to assemble, detailed blueprints and instructions.

Small portable 9" x 6" x 4¾". Wt. 6 pounds. Ideal for taking on service calls Complete your service shop with this instrument

$19.50 Nothing ELSE TO BUY

HEATHKIT SIGNAL GENERATOR KIT

Every shop needs a good signal generator. The Heathkit fulfills every servicing need, fundamentals from 150 Kc. to 30 megacycles with strong harmonics over 100 megacycles covering the new television and FM bands. 110V 60 cycle transformer operated power supply

400 cycle audio available for 30% modulation or audio testing. Uses 6SN7 as RF oscillator and audio amplifier Complete kit has every part necessary and detailed blueprints and instructions enable the builder to assemble it in a few hours. Large easy to read calibration. Convenient size 9" x 6" x 4¾". Weight 4½ pounds.

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THE NEW HEATHKIT VACUUM TUBE VOLTMETER KIT

The most essential tool a radio man can have, now within the reach of his pocketbook. The Heathkit VTVM is equal in quality to instruments selling for $75.00 or more. Features 500 microamp meter, transformer power supply, 1% glass enclosed divider resistors, ceramic selector switches, 11 megohms input resistance, linear AC and DC scale, electronic AC reading RMS. Circuit uses 6SN7 in balanced bridge circuit, a 6H6 as AC rectifier and 6 x 5 as transformer power supply rectifier Included is means of calibrating without standards Average assembly time less than four pleasant hours and you have the most useful test instrument you will ever own Ranges 0-3, 30, 100, 300, 1000 volts AC and DC Ohmmeter has ranges of scale times 1, 100, 1000, 10M and 1 megohm, giving range .1 ohm to 1000 megohms. Weight 8 lbs.

$24.50 Nothing ELSE TO BUY

HEATHKIT CONDENSER CHECKER KIT

A condenser checker anyone can afford to own. Measures capacity and leakage from .00001 to 100 MFD on calibrated scales with test voltage up to 500 volts. No need for tables or multipliers Reads resistance 500 ohms to 2 megohms 110V 60 cycle transformer operated complete with rectifier and magic eye indicator tubes.

Easy quick assembly with clear detailed blueprints and instructions Small convenient size 9" x 6" x 4¾". Weight 4 pounds. This is one of the handiest instruments in any service shop.

$19.50

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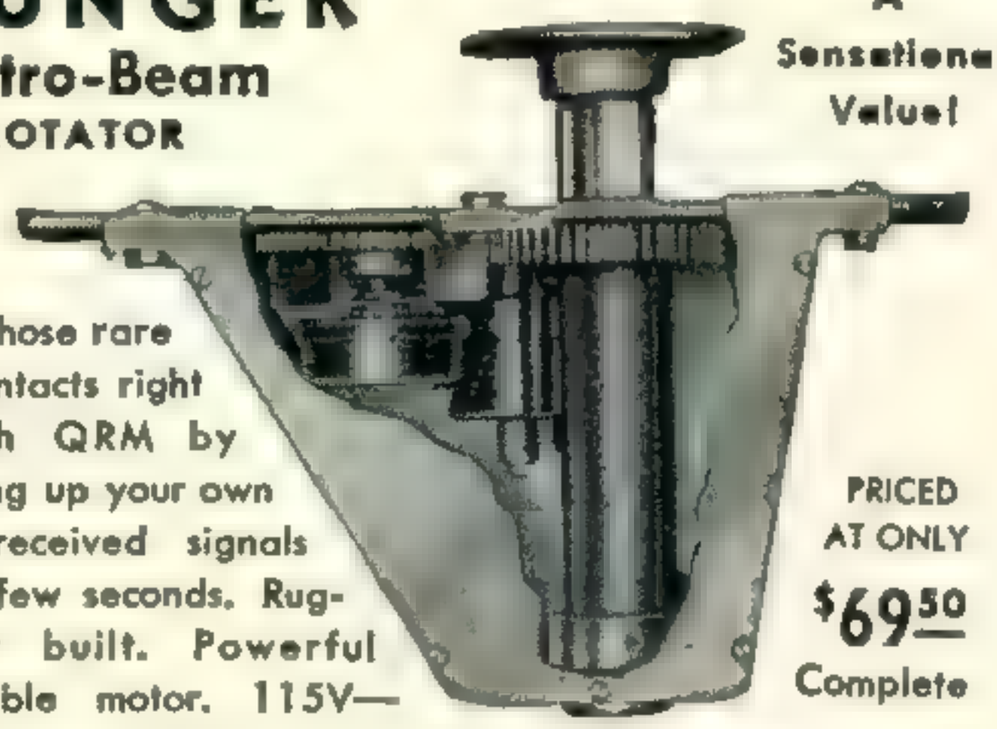

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Order today. If not satisfied, return rotator within 10 days for refund. (Control-power cable supplied at 10c per ft. in 50' or 100' lengths.)

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NEW! RG8/U COAXIAL CABLE 52 OHM

500–2500 ft. **$30.00** per M 5500–10,000 ft. **$25.00** per M
3000–5000 ft. **27.50** per M 10,500–20,000 ft. **22.50** per M
over 20,000 ft. **$20.00** per M
No Charge For Reels

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UG 87U (Baby "N" Socket with Hood) Gold Plated ..... **50c each**
83-1H hood ..... **10c each**

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Only $7.25 pair
115 V., 60 Cyc. - 3¼" dia. x 4½" body. NO. C78248
Also 50V., 50 Cyc. $4.75 pr.
USED IN PAIRS FOR REMOTE CONTROL

Selsyn Differential—115 v., 60 cyc ..... **$2.25 ea**

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.1 mfd	12000 V. DC..	**$4.95**	3 mfd	1000 V. DC..	**$.80**
.1 mfd	7500 V. DC..	**1.95**	1 mfd	800 V. DC	**.40**
.1-.1 mfd	7000 V. DC..	**2.45**	4 mfd	600 V. DC..	**.59**
.4 mfd	1000 V. DC..	**1.00**	1 mfd	600 V. DC..	**.29**

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Only **$3.85**

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6J4 g.g. amplifiers, and with this set-up he can work 200 miles, four nights out of five, and hears W9TKL in Waukegan, Ill., at 300 miles, quite often. Al mentions that more activity is needed in Ky., W. Va., Va. and Md.

During the Providence, R. I., Hamfest in May we were fortunate in meeting some of the R. I., 2-meter gang, which included W1JFF, W1KLH, W1KIM. We found that W1LKH has really gone in for 2 meters in a big way. The rig at W1LKH is *1 KW* to a 48-element vertical beam and with a receiver which should be tops, for it includes four stages of 2C40s as amplifiers, 4C40 as g.g. mixer, and a 2C40 as osc. His beam is fixed on Fla., and with an almost entirely salt-water path from him to Fla. it should happen at any time. W1LKH looks from 2300-2400 EST nightly for the Fla. gang.

During the opening on April 19, VE1QY worked, between 2015-2255 EST the following; W1SF, W1DAH, W2BAV, MO, NPJ, NLY, MGF, BGF, SVI, NGA, UPY, WLS and heard W1BCN, DHX, PBB, W2QJF, KDX and W2MCG. Jerry mentions that the stations in and around N. Y. City and N. J. were very loud, while the W1s closer to him were ,weak, with none of the Boston area signals getting through. Jerry's rig runs 15 watts to a 522, and an 8-element vertical array, with a BC624 AM receiver.

WØCCY, in Council Cluffs, Ia., reports that these are active on 144 mc: WØSEE, QFZ, CCY; and on Omaha, Nebr.: WØLHZ, FSR, OJU, QXR, with not so much regular activity from the Omaha gang. Most all of the gang have 522s in their collection, but few have them in use at present. WØCCY is able to hear WØWHZ in Red Oak, Ia., some 75 miles to the south but no contact has been made. Several other weak fading carriers have also been heard, so WØCCY is adding a 2C40 g.g. amplifier and a power increase is contemplated. How about joining the skeds of the Mo.-Ia. gang?

W8WRN has 40 watts to an 829B on 144.86 mc and on May 1 to May 2 an opening occurred to allow Ken some nice contacts in the order of 200-300 miles, with these stations worked: W8CYE, W8WJC, W8WXV, W8WNM; with W8WSE, W8NBM and W3REU being heard. A new 16-element horizontal is soon planned at W8WRN, as well as monthly reports.

Elmer Walker, W7LYA, who just received his license after being an ardent v-h-f listener, reports there are over 30 stations on 144 mc in the Seattle area, with common distances worked being 60-70 miles.

W6WNN says that although they can't work into the L.A. area on 6 meters, the 2-meter band allows nightly contacts from the San Diego area. This helps keep up Poncho's v-h-f spirit anyway.

The Great Beyond

Those fellows, W6ET and W6IFE, are at it again! On 2300 mc, April 25, between 1315–1540 CDST, two-way contact was established between Mt. Hamilton and General Grant Park, a distance of 150 miles. At W6ET, W6BON, assisted with the gear, and W6SX provided the power and permission to set up on the observatory property, as well as furnish a standby circuit on his 144-mc rig. W6IFE was assisted at General Grant Park by his XYL, Marty, and by W6PSQ, who very conveniently happened along in time to say a few words over the circuit.

To all of you W1s who provided us with such a nice visit while in the Boston area, our hearty thanks and let's hope you can make it to Gashland some time.

Postscripts

Rescue Operations

Several Winnipeg hams assisted when atmospheric conditions cut off normal communications. On April 4th at 12:45 a. m. Stuart Talbot, VE4SR, and Rudy Peters, VE4RP, picked up a call from Capt. Hank Koaler, a ham in Churchill, requesting an RCAF plane to rescue an Eskimo child who had been badly burned at Baffin Island. With several other hams standing by if needed, the two stayed on the air until 3:45 a. m. to see that the message was forwarded to RCAF headquarters. The following day it was learned that arrangements had already been made for a U. S. plane to make the Arctic mercy flight from Halifax, but high praise was paid the amateurs for their early morning vigil.

Danger High-Voltage!

"Danger High-Voltage!" decals have been prepared in the interest of amateur radio safety by Allied Radio Corp., and are being made available free of charge to individuals or clubs for distribution to all members. Two color decals, measuring 2¾ x 4" will be supplied for as many pieces of equipment as requested. A QSL or postcard addressed to Allied Radio Corp., 833 W. Jackson Blvd., Chicago 7, Ill., is sufficient.

Puerto Rico Amateur Radio Club

Directors of PRARC and a VE visitor. Left to right, standing: George Mayer, KP4BJ; Paul Girard, KP4CB; Rafael Acosta, KP4BG; Dr. William Gelpi, KP4DP, vice president; Jose Gotay, KP4BL, treasurer; Lorenzo Simo, KP4BA; secretary. Seated: Miriam Gillier, XYL of VE3AZI; Alicia Rodriguez, KP4CL, president; Ulises Marin, KP4JA. The PRARC now numbers 60 members and has recently initiated a club paper, "Ground Wave." Latest news from the club is that to the Puerto Rican award W.P.R. issued to those stations contacting 25 KPs, another certificate has been added for hams who have worked 50 KPs.

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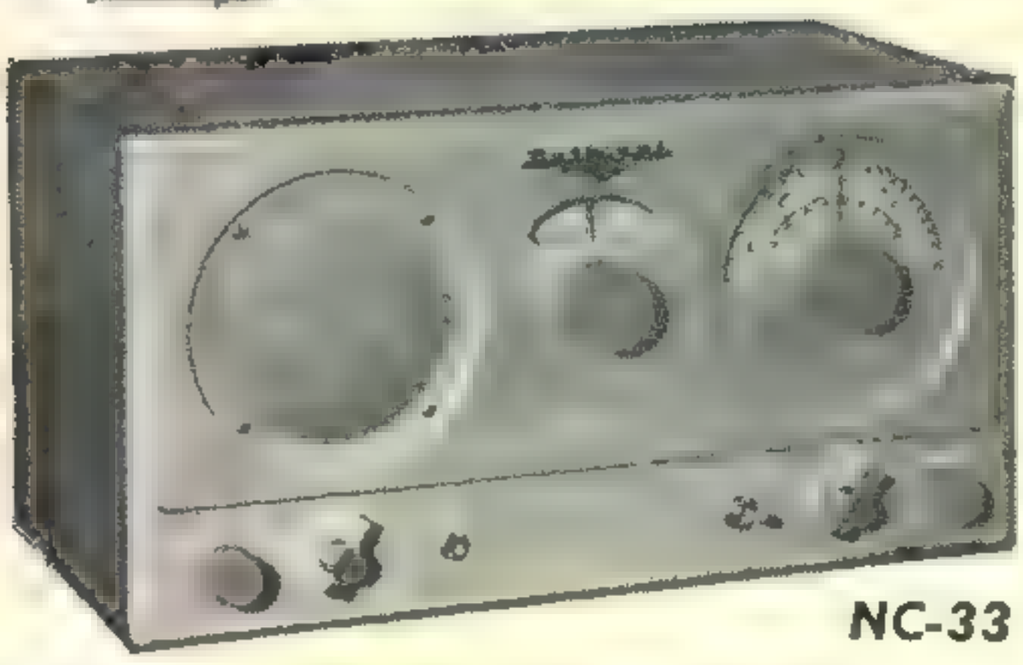

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THE NEW NATIONAL NC-33

$65.95 Amateur Net

- Operates from 110-120 volts AC or DC. Ideal for shipboard and other uses where DC only is available.
- Electrical bandspread on all bands! Broadcast, amateur, police and foreign bands plainly marked.
- A real communication receiver covering all frequencies from 500 kcs to 35 mcs.

POWER SUPPLY SPECIAL

1 Plate transformer 660-550 V. @250 ma. • 1 Filament transformer 5 V., 3 amp. • 1 Swinging choke 4-16 Hy. 250 ma. • 1 Smoothing choke 10 Hy. 250 ma. • 1 RK 60 rectifier • 1 Socket • 1 Chassis (undrilled)

$24.95 complete

816 POWER SUPPLY SPECIAL

1 Plate transformer 660-550 V. @250 ma. • 1 Filament transformer 2.5 V., 5 amp. • 2 816 tubes • 2 Sockets • 2 Platecaps

$9.95 complete

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TRANSMITTERS

- B.C. 457 4-5.3 mc. **$5.95**
  B.C. 458 5.3-7 mc. **$5.95**
  B.C. 459—7-9.1 mc (new). **$9.95**

ARC/5—7-9.1 mc 40 m..... **$7.95**
ARC/5—4-5.3 mc 80 m..... **$5.95**
Special both for..... **$11.95**

RECEIVERS

- B.C. 454—3-6 mc (new)..... **$6.95**

MODULATOR UNITS

- B.C. 456..... **$3.95**
  MD-7/ARC-5, used (Push-pull 1625's) **$7.95**

OIL FILLED CONDENSERS

- 2 mfd-4000V..... **$4.95**
  3 mfd-4000V..... **$5.95**
  2 mfd-5000V..... **$6.95**
- Jeff Transformers, primary 117 V. at 60 cycles. Sec. #1, 250 V.D.C. at 150 ma D.C.; Sec. #2, 6.3 V. at 5 amp.; Sec. #3, 5 V. at 3 amp..... **$3.95 ea.**
- B.C. 357 Beacon receiver tunes to 75 meg., has current relay. Operates on 2 mils. 1/tubes..... **$2.39**

FL8 Audio Filters **$1.39**
(See June issue CQ)

TUBES

872 (Rectifiers) **$1.19** 861 (Tetrode) **$9.95**

Cash with order. Express C.O.D.

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Hamfests

Peoria Amateurs Hamfest

The Peoria Radio Amateurs' Assn. will hold a hamfest on June 27, 1948, near Dunlap, Ill., it has been announced by the club's president, W9DXF.

Golden Empire Club Hamfest

The Golden Empire Radio Club of Northern California will hold its annual summer hamfest on June 27, 1948, in Chico, Calif. Registration at $1.65 includes lunch, prizes and entertainment.

Society Radio Operators Hamfest

The Society Radio Operators, Chicago, will hold their eighth annual hamfest picnic on July 25, 1948. The place: Orchard Grove, Maine Township, Ill. The main prize: A television receiver.

Southwestern Division Convention

The Southwestern Division of A.R.R.L. will stage its annual convention at the Alexandria Hotel in Los Angeles, Calif., on October 2 and 3, 1948, under sponsorship of the Council of Radio Clubs. Conventioneers are also invited to attend the 4th annual Pacific Electronic Exhibit to be held at the Los Angeles Biltmore on Sept. 30, and Oct. 1 and 2.

Eastern Canada Convention

The Eastern Canada A.R.R.L. Convention will be held at the Mount Royal Hotel, Montreal, on October 8 and 9, 1948. Advance registration, $5.00 for the OM, $3.50 for the XYL. Send registrations to Convention Committee, Montreal Amateur Radio Club, Box 1, Station "D," Montreal, Que., Canada.

National A.R.R.L. Convention

Four thousand hams! Forty thousand square feet of display space! Top-notch activity for the YL and XYL! Technical and v-h-f program! Prizes galore! Entertainment and *Gemutlichkeit!*

Wrapped into three days of hectic activity will be the first National A.R.R.L. Convention in ten years, to be staged by the Milwaukee Radio Amateurs' Club in the block-square Milwaukee Auditorium during the coming Labor Day week-end.

Hard by the downtown business and hotel area, the Milwaukee Auditorium will resound with a continuous program which will get underway early Saturday morning, Sept. 4, and continue until Monday night, Sept. 6. Under the direction of Jack Doyle, W9GPI, who has surrounded himself with a group of ham specialists to guide preliminaries into proper grooves, the conclave will bring together amateurs from every one of the forty-eight states. All the leading equipment manufacturers will join with the hams in a display of ham gear never before duplicated under one roof. And each of the district QSL managers has been invited by the convention committee as a reward for a thankless task.

The governor of Wisconsin and the mayor of Milwaukee will offer official greeting; League executives, F.C.C. Commissioner Geo. E. Sterling, and a host of famous hams will be there to discuss technical advancements and amateur radio politics and achievements with the fellows. A Black Forest Evening featuring Milwaukee's famous *Gemutlichkeit* parties, with plenty of food and drink, will high light Saturday night's activity. The v-h-f section will operate throughout the convention program in special meeting halls under the Auditorium's spacious roof. Sightseeing tours, a competition for mobile installations attending the convention, hid-

den transmitter hunts, Army and Navy demonstrations, and special features for the ladies are on the agenda.

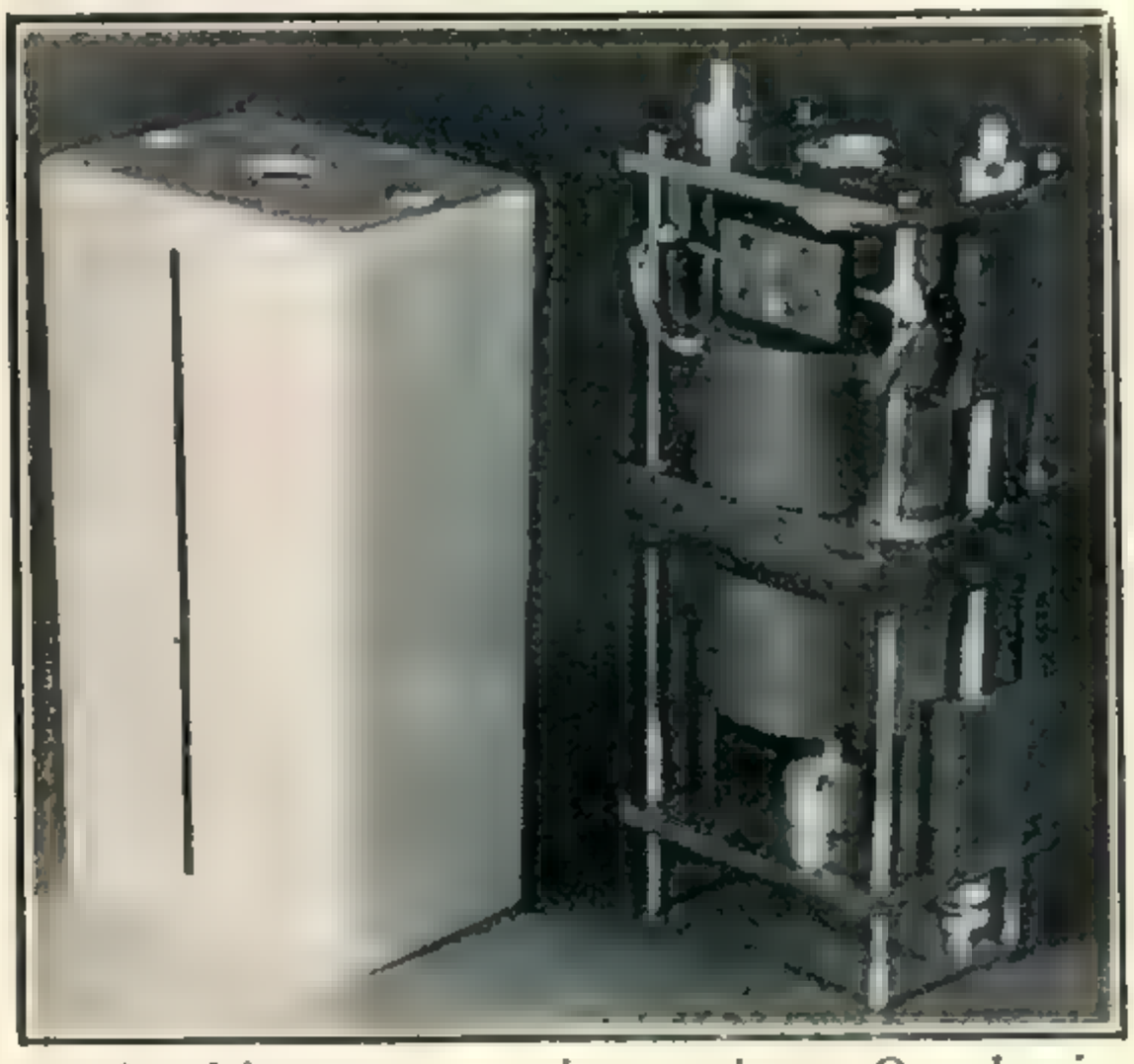
One of the major items of the program will be A.R.R.L. President George W. Bailey's address Sunday night. That night will also find a party in the main arena, with both professional and amateur "ham" entertainment. The Milwaukee gang has arranged a Wouff Hong initiation which will be talked about on ham channels for many a moonlit night.

The registration charge is $7.50 per person, with no extras for children accompanying parents. Special inducements for advance registration include favorable hotel accommodations, a chance at some added prizes, and the opportunity to get the whole thing off your mind before you head the gas buggy for Milwaukee next September.

PARTS AND PRODUCTS

(*from page 54*)

lite mounting platforms to support the coils. The coils are wound with litz wire and are encased in a



powdered iron cup, assuring maximum Q and gain. The entire unit is shielded by an extruded aluminum shield can of special design.

THE YL's FREQUENCY

(*from page 45*)

the Southwestern Division Convention to be held at Los Angeles, Calif., October 2 and 3. Jackie, W9AYX, is in charge of the ladies' program during the Milwaukee affair. Evelyn, W6NZP, is district committee member for the S.W. convention, and the entire YL Club of L.A. is busy planning special YL activities it will sponsor during the convention. More details next month.

The girls of the N.Y.C. YLRL are bringing their Spring season to a close with a flurry of activity. May 15th was the occasion of the third annual Spring luncheon, held this year at the Russian Tea Room on West 57th St. Twenty-eight YLs gathered for the really FB affair at which we were happy to welcome Lil, W2PMA, after her long siege of illness. The club meeting for May, held a week after the luncheon, was turned into an open session with OMs invited to hear Larry, W2IOP, discuss the

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BC-223 XMITTER w/PE-125x 12 or 24 VDC power supply. Uses 801 osc, 801 fin PP 46 mod. & 46 speech amp. 4-pre-set xtal freq. or MO control. Output 10 watts phone or cw. freq range 2 Mc.-5.25 Mc. comes w/set of operating tubes & spare tube box w/set spare tubes: power supply also comes w/spare tubes & vib. This set is new w/shock mounts & tuning units in cases..... **$49.50**

CW filter 1000 cyc FL-5c used excellent..... **.95**

4-Section oil condenser 8-8-8-8 mfd 600v. new, with clamps ..... **$1.95** 2 for **$3.50**

BC-923 FM recvr. 27-38.9 Mc. in four channels which can be manually tuned through the range, has xtal calibrator w/1000 kc. This recvr uses double conversion & sens. of 1 microvolt. Operates from 12 VDC input with built in speaker comes w/tubes, xtal & dyn. Used good cond. only **$18.95**

BC-924 FM xmitter companion to BC-923 w/four preset channels from 27-38.9 Mc. Uses 815 tube in final with 30w output. Comes w/tubes 12v dyn in used good cond... **$14.95**

Combination of BC-923 & BC-924.... .... **$32.50**

Transtat, 0-130v AC 50/60 cyc, 22.5 amps max used **$29.50**

Transtat, regulator 90-130 vac 17.4A 50/60 cyc new **$22.50**

Variac, 0-130 vac 50/60 cyc 7.5A max..... **$14.95**

ARC-5 EQUIPMENT

R-27 recvr 6-9.1 Mc. new w/tubes & dyn..... **$6.95**

T-22 xmitter 7-9.1 Mc. w/tubes & xtal used Good.. **$5.95**

New..... **$7.95**

274N or ATA/ARA Command Equipment

Xmitter 2.1-3 Mc. covers boat freq. w/tubes, xtal used excell... **$7.95**

Xmitter 4-5.3 Mc. 15 meter band w/tubes, xtal used **$4.95**

Xmitter 5.3-7 Mc. w/tubes, xtal used..... **$4.95**

Xmitter 7-9.1 Mc. w/tubes, xtal used excell..... **$6.95**

RCVR 6-9.1 Mc. w/tubes & dyn. used, **$4.95** new **$6.95**

XFORMERS 110 VAC 60 C PRIMARY

Replacement xformer (original) for type 224 oscilliscope new **$18.95**

3640 VAC CT @ 200 Ma. gray case herm. sealed new **$11.95**

860 VAC CT @ 510 Ma. 5 VAC @ 6A gray case herm. sealed, new..... **$9.95**

2.5 V VAC @ 10A for 836 or 866 tubes gray case, new **$2.95**

1750 VAC @ 5 Ma. 2.5V @ 1.75A scope xformer, new **$3.95**

1750 VAC @ 7 Ma. 2.5V @ 1.75A, 6.3V @ .6A, new **$4.95**

6.3V @ 12A, 6.3V @ 12A gray case herm. sealed, new **$2.75**

BC-610 modulation xformer 100TH's to 250TH, new except insulators split bargain at **$8.95**

SJ, SE, SH, MK-16 Radar xmitter-recvr contains duplexing unit, 706 magnetron, keying circuits, local osc & amp, AFC unit, blower motor w/15 tubes used excell cond..... **$59.50**

Include sufficient funds for Parcel Post, excess will be refunded. 30% Deposit.

All items subject to prior sale or change of price without notice.

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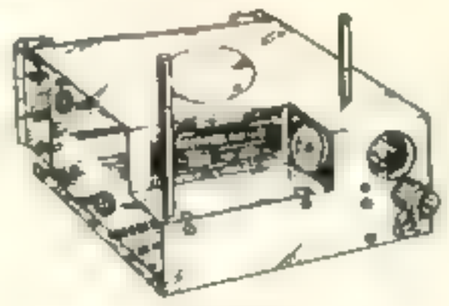
RA 20 POWERPACK.....$7.95

Converts BC-312 receiver to AC operation. Fits in dynamotor compartment. Also for external use with BC-348, 314, 224, and used with BC-696 & 459 as ECO. Input 110-120 VAC 60 Cycles. Output 250 VDC @ 95 Ma, 12V @ .6A, 12V CT @ 3A. Shipping weight 12 lbs.....



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BC-610 Components Modulator Decks Less modulation transformer. Completely wired..... **$14.95**

11 Hy. .600 Amp. chokes..... **$7.95**

2½ Volt 10 Amp. 866 filament transformer BC610.. **$3.50**

VIBRATOR POWER SUPPLY KIT

150 VDC at 40 MA. Use with portable receivers. Consists of power trans., synch. vib. and socket, two 8 mfd at 450 V condensers, resistor. Value..... **$8.50**

Price only **$4.25**

SENSITIVE RELAY 8 000 ohm coil SPDT **$1.25**

FILTER CONDENSERS

8 mfd —1000 VDC... **$1.45**

8 mfd—2500 VDC **4.50**

NARROW BAND FM ADAPTER

Noise Free Reception!

Only adapter for BC-348 receiver using 915 KC IF. Also made in 455-465 Kc Model 3¾ x 4⅛ x 1½". Completely Chromium Plated. Easily mounted. Uses 6AK5 limiter and 6AL5 discriminator. Instructions supplied.

Price (less tubes)..... **$10.95**

6AL5 tubes.....**90c** ea. 6AK5 tubes . .**90c** ea.

MICA CONDENSERS

50 mmf—8000 VDC Can be used in parallel with tuning condenser to extend frequency range of transmitters. Sangamo type F3L. **$2.50**

100 mmf—5000 VDC Sangamo type F2L **$1.50**

50 Watt tube sockets similar to National XM50..... **60c**

Write for FREE Merit Catalog using all other transformers and chokes

TERMS: 30% with order. Bal. C.O.D. F.O.B. Chicago

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LISTEN ONLY to the Signal You WANT to Hear

FL-8-A FILTER - 1020 CPS.

Bust through the QRM. Connect this filter between output of receiver and headset. Filter will pass 1020 CPS, eliminating others. Everybody needs this amazing unit. **WAR SURPLUS ITEM—BRAND NEW**, in original cartons made by UTC. Give-away price **$2.85**, including two cords, plug and extension jack. Postage 15c additional. They won't last long. RUSH YOUR ORDER.

OFFENBACH & REIMUS CO.

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El Hermanson, W4CQL, operating as AR1YL. Her transmitter was concealed in the desk.

growing problem of TVI. For the June meeting, which will be the last until Fall, the club is planning to visit the newly opened United Nations station, K2UN, at Lake Success—which, by the way, Vi, W2JZX, was the first YL to operate.

In Los Angeles the YL club held their April meeting at the home of the L.A. club president, Clara, W6TDL. They welcomed a new member, Mary, W6AVF, and two visitors, Downs, W6WMA, and Fern, XYL of W6ANH. The May meeting was held at the home of Enid, W6UXF, the main business of the meeting being the annual election of officers. Those elected are: President, Maxine Willis W6UHA; secretary, Violet Sasse, W6CBA; treasurer, Ida Carney, W6BIS. The June meeting, final one of the season for their club, will be a special celebration at the Hollywood-Roosevelt hotel for the installation of new officers.

The San Diego YLRL celebrated its first birthday as a club with a picnic on May 16th at El Monte Park. "We decided on an informal picnic," writes Eleanor, W6AWW, "because between us gals we have 20 children and we thought it would be nice if they could get acquainted. The YLs and OMs played baseball, and, speaking from experience, many were limping around for days afterwards!" At the regular May meeting, instead of a speaker, entertainment chairman Blanche, W6BLF, showed movies. For the June meeting the S.D. club is planning to visit Los Angeles for the L.A. installation-of-officers meeting.

Personal Mention

Lenore, W6NAZ, recently completed several weeks of work on a television program which she reports was a great success. She describes it thus: "We did a variety show which included the video translation of the radio show, 'Life of Riley,' and a play which I wrote and directed, 'We Hereby Nominate . . .' It ran for two weeks, and I am proud to say it was the most finished television production (studio type) done on the West Coast."

Iris, VE1AYL, is secretary of Loyalist City Amateur Radio Club in St. John, N.B. . . . Jean, W6ZZD, is the first YL in San Diego to operate on 2 meters. . . . Margie, W4LDC, has her first jr. op. Margie operates 10-meter phone in company with her father, W4MOT, and her OM, W4KYK. . . . Three other YLs have new jr. ops. Naomi, W6YZU, and her OM, W6LEE, had a boy on May 3rd; Dot, W1FTJ, and her OM, W1BFT, had a girl on May 15th; and Carol, W6WSV, and her OM, W6WSW, had a girl on May 20th.

YL of the Month

For our YL of the Month we're presenting a real DXer, one who not only has worked it, but has been DX herself—El Hermanson, W4CQL, who for the past year operated in Syria as AR1YL.

El got her ticket back in 1933, and has been operating ever since, usually c.w. Her OM, W2BFS, comments: "Although I was the one who taught her radio originally, I couldn't sign her up as my wife until 1938, and I still think she was mostly attracted by the idea that she wouldn't have to build her own rigs any more—hi!" The couple who stood up with them for their wedding, by the way, were W4CQJ and W4CQK. The OM was then W4ASA.

Early in the war El put the YLs in high-speed wireless for the first time by becoming Press Wireless' first woman operator. She also worked in WERS, operating mobile WNYJ-98.

El was the first, and probably the last (for a long time) YL operator in Syria. Both she and her OM, AR1OM, hammed in Damascus, but El did the bulk of it. It was definitely out of order to be hamming there, and being Americans in a city with very few of their own people they had to be very careful to avoid drawing any attention to their activities, innocent as they actually were. They also had trouble with local power, the line voltage dropping as low as 75 in the evenings. In spite of this, El managed to work many countries, although not very many Ws, for it was hard to get out toward the west because of two chains of mountains west of Damascus.

El's OM tells us (where she modestly would not) that she was a big booster for ham radio in Syria and went out of her way to try to convince various influential Syrian people to legalize ham radio. The transmitter she used, a Collins 32RA, was sold to a local ham, AR1RJ, who is the only ham in Syria who has any official permission to operate.

Now the Hermansons are back in W-land, and after visiting such interesting spots as Egypt, Baghdad, Turkey and Lebanon in the Middle East, as well as several countries in Europe, and experiencing such minor difficulties as being in the center of a big riot in Damascus with bullets flying all around, El has plenty of material to keep her key pounding for many an hour at W2BFS upon their return to New York. But before then they are planning an air visit to Mexico and Guatemala, as well as an auto trip in the U.S. during which W4CQL will be operating 10-meter mobile.

SCRATCHI

(*from page 10*)

this are being done toob doesn't need neutralizing and there are no parasitics. (Scratchi are still having trubbles on this item. He are getting rid of neutralization and parasitics but so far he are also getting rids of any outputs.)

Scratchi's Sooper Secret Cadoodaler are reely taking the frosting off the cake when it are coming to antennas. Not only are it automatically making final load to rite current, but it are making any antenna work regardless of length of same. This are being big boom to hams living in apartments. I are also running into bits of trubble here, as black box are getting hot as 6L6 with 100 whats input when I are using it with reel short antenna. I are thinking of reckamending that in this case S.S.S.C. being used in bath tube full of water.

I are now working on the last two things that will making S.S.S.C. revolutionary. First, I are trying to fixing it so that when black box are in serious

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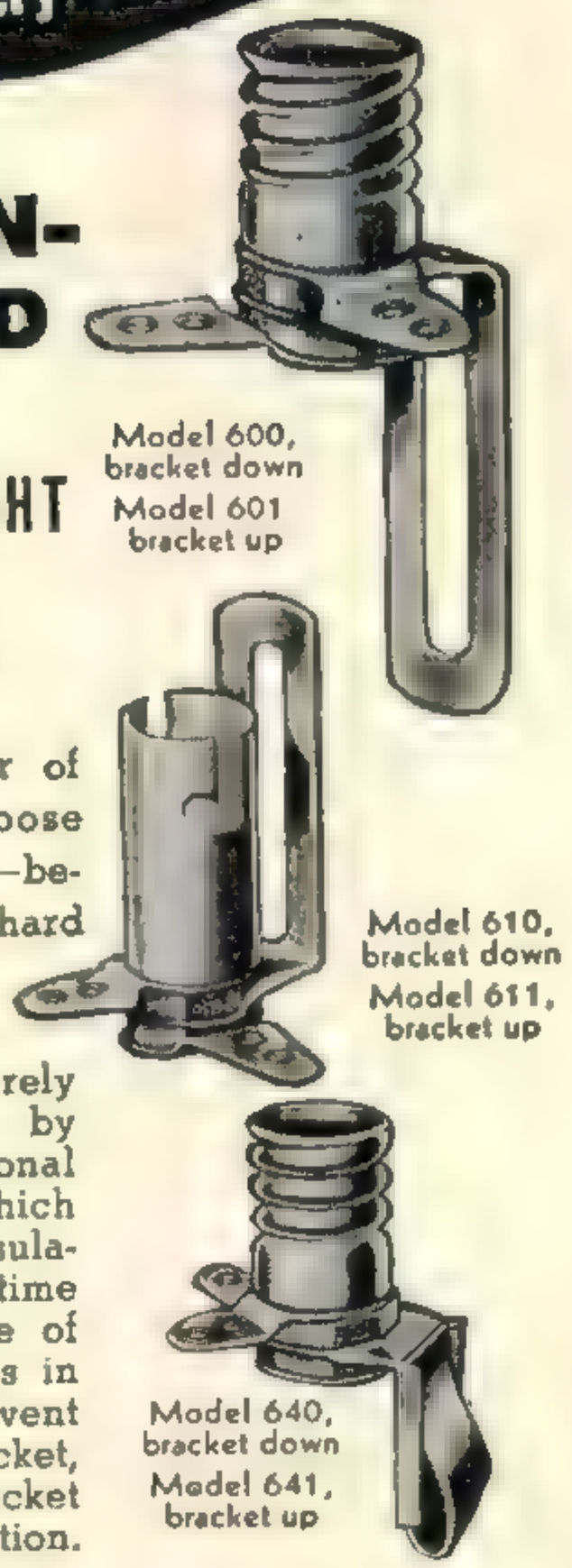

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between key and place where key are normally plugged in there will be no key clicks and all fists will be sounding like coming on hot-stuff" tape. But this are probably being easy compared to what I are wanting to do for all foney men. I are hoping that Scratchi's Sooper Secret Cadoodaler will be making it impossible to overmodulating. Of course, Hon. Ed., this are having to work on NBFM and Phasey Modulation as well as AM.

It are while I are deep in mental contorshuns on this last item that I are deciding to go on air. Hee, hee, Hon. Ed., I are going on and having three conseckutive QSOs with same feller. Must have been a young squirt as he are giving Scratchi 557 reports on first two contacts when I are signing different W calls, but third time, when I are signing a C8 call he are giving me 599X. Incidentally, are you knowing a printer who can print me a cupple hundred QSL cards, all different? I are able to pay two bux, if he do reel good job.

When I are working out rest of details on Scratchi's Sooper Secret Gadoodaler I will be riting you again as I are having nifty idea for selling stock in S.S.S.C. and I knowing you will be wanting to be in on grounded floor.

Yours respectively,
Hashafisti Scratchi

MODIFICATION OF THE 274N

(from page 44)

the 1629 (pin 8) from the junction of these two resistors. Then solder a 2500-ohm 2-watt resistor between the cathode and chassis ground. The magic-eye now operates normally with the eye closing when the v-f-o frequency equals the frequency of the calibrating crystal.

Power Supply and Connections

We were able to obtain a dual rack for our two v-f-o units. These also have socket connections at the rear for the control and power plugs. By removing the screws at the back of the power receptacle box all the wiring becomes accessible. It is best to remove all of the wiring and start out fresh.

Remove the small socket and replace it with a 4-prong socket to handle the voltages coming from the power supply. In the center of the power receptacle box mount a DPDT toggle switch. This switch is to be used to switch the plate and screen voltages from one v.f.o. to the other. The filaments of the two units are wired in parallel.

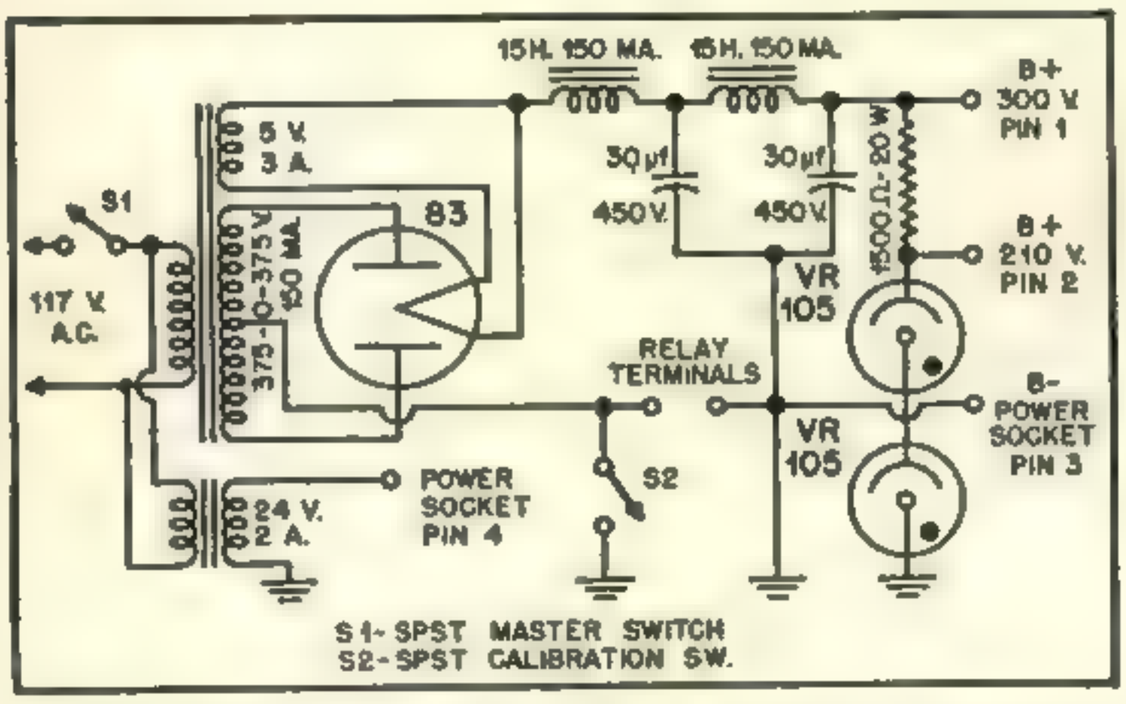

Fig. 2. Voltage regulated power supply recommended for use with the SCR-274N as a v.f.o.

A well-regulated power supply is the key to the stability of any v.f.o. After a number of experiments

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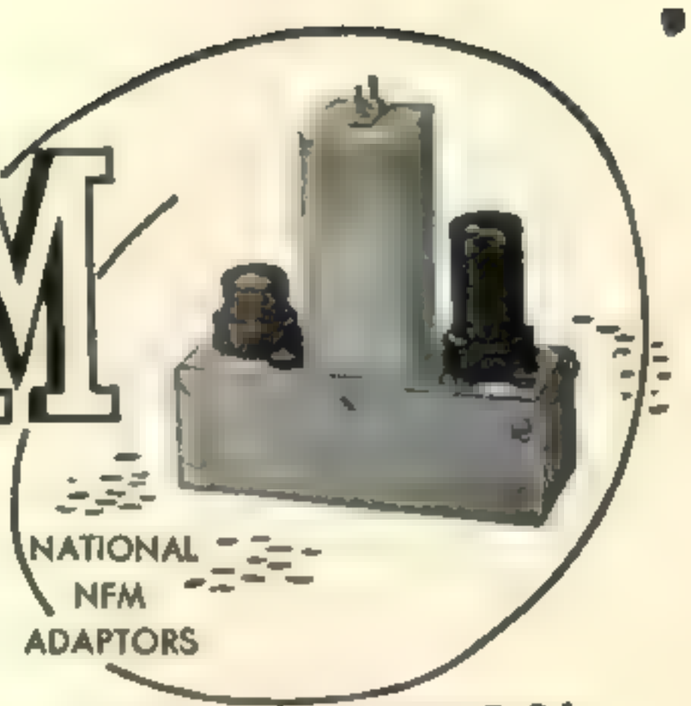

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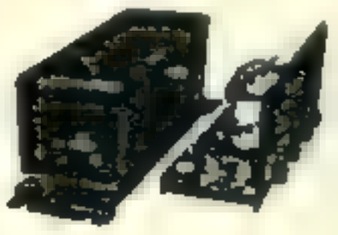

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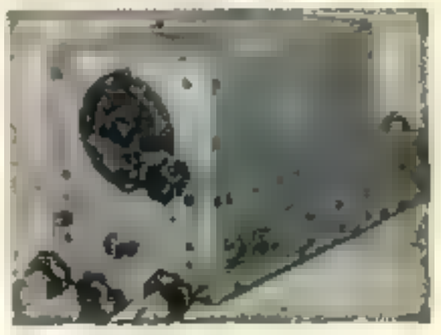

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and checks on the output and drift we arrived at these voltage and current ratings. For strictly stable v.f.o. operation, not more than 300 volts at 100 ma on the plates of the 1625 amplifiers, and 210 volts on the oscillator stage. If the unit is to be used on either 40 or 80 meters 500 volts at 200 ma can be used and still afford a reasonably clean-cut signal. The oscillator voltage must be well-regulated and a suggested power supply is shown in *Fig. 2*. Two VR 105 tubes in series keep the oscillator plate and amplifier screens down to a current drain of between 30 and 40 ma, by providing 210 v. of stabilized d.c. The double section filter in the power supply is worth while, thus keeping the ripple content down.

To set the v.f.o. to a spot frequency chosen on the receiver, a calibrating switch is included in the power supply proper. Since the two units are mounted side by side it enables the operator to set up without causing needless QRM by having the entire transmitter on the air.

Keying

Many types of keying circuits have been tried with this v.f.o. For the author the most satisfactory has been to use relay *K53* and key the cathodes of the 1625 amplifiers. This relay will operate nicely from a 22-volt battery, or through a 10-watt 17,000-ohm resistor from the 300-volt supply. The relay draws about 16 ma from either the battery or the dropping resistor.

V. H. F. GROUND WAVE DX

(*from page 41*)

ating wavelength develop the peculiar tendency of decreasing the intensity of signals *close-in* between 30 and 100 miles. This effect has often been observed on both bands and some operators are sufficiently experienced to recognize it and use it as an indication that good DX conditions exist on paths further out. On 2 meters we see that a duct 700 feet high produces a smaller field at distances below 120 miles than ducts from 350 to 550 feet. A similar effect on 6 meters is found for ducts greater than about 1100 feet when compared to those of less than 850 in height. Thus, at 2 meters when signals heard on smaller ducts at distances of 80 to 100 miles start to decrease in signal strength it may indicate that the duct is enlarging and signals beyond 100 miles may soon start coming in.

The question of maximum ranges for these two bands proves rather interesting as amateur observations further support the use of the Booker Mode Theory. At 6 meters, for example, the usual maximum range noted during the Summer and Fall months is about 250 to 275 miles, roughly corresponding to a duct of about 700 feet. Using this basis on 2 meters it indicates that the maximum range with the same conditions should be about 795 miles—a figure quite close to amateur 2 meter DX records.

THE "FLIP-FLOP"

(*from page 15*)

bulbs. If the balance control is properly set, the bulbs will light alternately, showing the switching is taking place. If they do not alternate properly, but only sit still and flicker, adjust the balance control.

The best setting of the sensitivity control is where the neon bulbs blink on and off two or three times a second. When the unit appears to be working properly connect the antennas, receiver input, and a-v-c lead. Readjust the sensitivity control if necessary and you are ready to go.

One use of the Flip-Flop is apparent as soon as it is turned on. The two antenna systems are compared directly several times a second. At one end of the band one antenna may sound "hotter" than the other. At the other end of the band conditions may be just the opposite.

Quite apart from fading, some signals may be nearly inaudible because they come from a direction which lies in a null of one antenna. By using two different antennas on the Flip-Flop the nulls are wiped out.

WØAZT suggests that a beam and a dipole be used with the Flip-Flop when hunting DX. The DX first appears on the dipole, because the beam is usually not pointed in the right direction. The beam is then swung around and the Flip-Flop then switches to the beam signal, several db higher than the dipole.

Since the action of the unit depends upon developing a-v-c voltage, it is not suitable for straight c-w reception. For frequency-shift keying and AM or FM phone work it performs excellently.

LIVE WITH TV!

(*from page 38*)

of the TV signal at a particular receiving location. If the amateur is fortunate enough to live in close proximity to the television transmitter where the field strength is very high, his spurious emissions can be correspondingly relatively higher in magnitude than the poor chap who lives in the fringe TV service area where the picture at its best is just above the normal site noise.

Because some of our readers may only have minor conditions of TVI due to the high TV transmitter field strength in their location, it may be possible to

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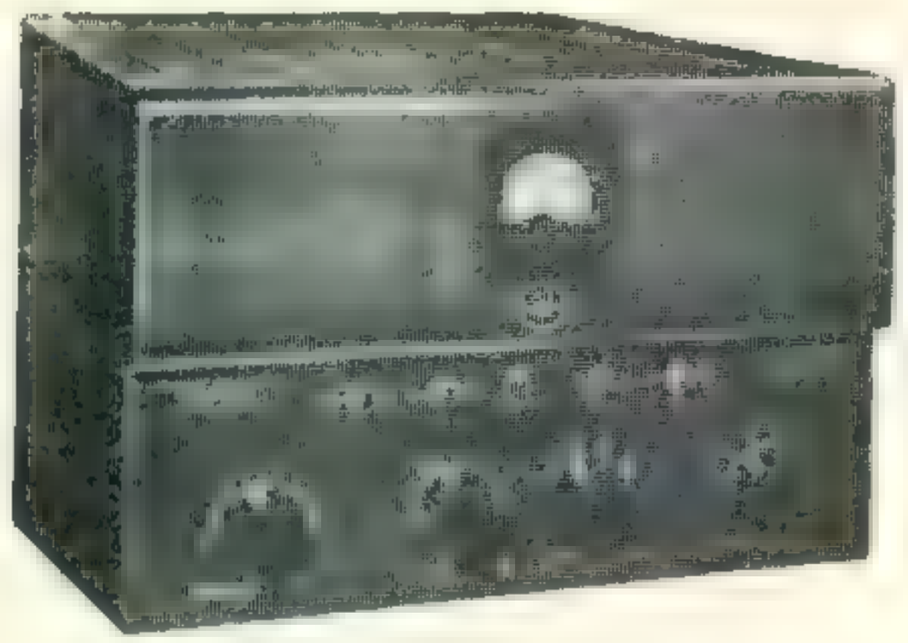

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(See article June CQ, Page 15)

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short cut the complete transmitter redesign job and the following is presented for those who prefer to perform step by step minor alterations, rather than to start from scratch and do the job from the beginning. Understand that in most instances, particularly when the TV receivers are in close proximity to the rig, the shortest way is to follow the major design changes previously discussed.

Verify that the alledged TVI is being caused by emissions from your amateur transmitter. From an analysis of the channels on which interference is experienced, determine whether the spurious emissions are harmonic or parasitic in nature. If parasitic, eliminate the parasites. If due to harmonic emission, ascertain in the following manner how the harmonics are being radiated.

Disconnect the plate voltage to the final amplifier. If the interference still is present, go back stage by stage until you isolate the offending circuit. Then isolate the particular portion of the cricuit that is responsible.

If on the other hand, cutting of the final eliminates the interference, remove the feeders, and load up the final by means of a dummy antenna. If the interference is eliminated by this step, stubs are indicated in the feed line, as treated previously in this article. However, if the interference is not eliminated, or substantially reduced by the dummy antenna, shield the dummy load. If interference persists, check with a wave meter for the presence of r.f. on the power lines feeding the rig. Likewise check the B supply and panel meter leads. Remember that short sections of wiring may be an effective antenna in the frequency range 50–220 mc. By the principle of isolation you will find the factors that are contributing to the radiation, and by shielding, rewiring, or by suitable filters, eliminate each offender.

It means work and more work. But you *can* live with television. Take your choice; do a complete rebuilding job and tame your spurious emissions, or isolate stage by stage. We've tried both and we vote for the first. It's less time consuming, more effective, means vastly superior signals on the air, and carries with it the feeling of a job well done.

THE TV RECEIVER

(*from page 35*)

insertion of a high-pass filter in series with the antenna lead, right at the receiver input. This should take the form of coil-condenser combination as shown in *Fig. 13c*, and should be mounted inside a shielded compartment, directly at the antenna terminals of the receiver. Another type of input circuit is the balanced input (*Fig. 13d*) circuit. This requires a balanced high-pass filter type of trap such as is shown in *Fig. 13e*. Both these traps should be designed for low frequency cut off at 50 mc. This will effectively reduce the possibility of driving the r-f amplifier or mixer grids positive, by the fundamental or lower order harmonics of your transmitter.

Another common fault which is frequently blamed on the amateur is produced by local oscillator voltage appearing at the antenna terminals of the receiver. This is radiated and can cause considerable

interference. This problem is also one of receiver design, but the knowledge of its existence can prevent numerous unjustified complaints against us. It has been shown that a signal greater than .01 microwatts across the 300-ohm input can cause objectionable interference in an adjacent television receiver 50 feet away, when the signal strength of the television transmitter is 500 microvolts per meter. Very few commercial receivers today even approach this figure.

The mechanism of this type of interference is as follows: A receiver operating on channel 2 with a conventional RMA standard 24-mc picture i.f. has its oscillator operating at 81 mc. This will beat with the picture carrier of a receiver tuned to channel 5 producing a beat of 3.75 mc, when the picture carrier is set on this i-f passband at 25.75 mc. In prewar receivers having a 12.75 mc i.f., interference results at the second receiver when it is tuned to channel 4, produding a 2.75-mc beat.

Some poorly designed receivers can produce this type of interference at distances ranging up to ¾ of a mile. On the screen this TVI looks like *Fig. 11*, the number of bars changing with the beat frequency. The prewar receivers also cause serious interference to channel 4 when they are tuned to channel 2.

The determination that interference is caused by a radiating receiver is not difficult, the tracking down of the offender generally is a tough job. Correlating the duration of the interference with the length of the program on the lower channel, particularly its presence whenever there is an especially good program on the lower channel, all are good tacks. Find the local chap who does not experience interference, and he probably owns the offending set.

Another phase of the TVI problem often blamed on us is radiation from the deflection circuits of a TV receiver. This causes BCL interference all across the broadcast band at 15.75-kc intervals. This again is a design problem which cannot be rectified by the amateur. Shielding the offending components and leads reduces this effect to a minimum.

To summate, view the receiver that is not working properly. Determine if normal operation is obtained when your transmitter is not on the air. If the received picture is inferior to that of a neighboring set of similar design, localize the trouble, and suggest the receiver be checked by a service man. If the faulty operation is produced by your transmitter, localize the trouble and correct it insofar as possible. If you feel that you cannot correct the trouble try to restrict your operation on the band that produces the trouble to a minimum. Make a point of reading the daily TV programs, and do not permit your operation to interfere with a first-class program of obvious wide public interest.

COMMENTARIES

(*from page 21*)

cathode taps and must be maintained. This ratio is dependent upon the frequency at which the oscillator is operating and may be found experimentally. It is possible to adjust the taps so that a positive shift due to the plate voltage change is cancelled by

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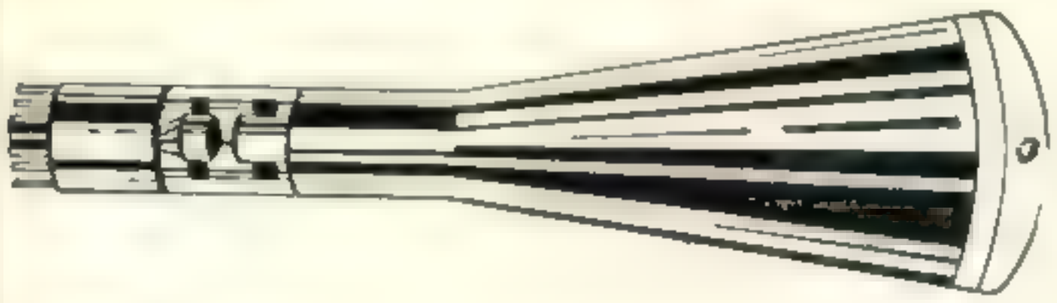

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(See article June CQ, Page 15)

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a negative shift due to filament voltage change or vise-versa. One very important consideration that is overlooked in nine cases out of ten is the position of the grid tap. Generally, the grid is hung on to the top of the inductance, because it is easier than taking another tap. For high stability the grid should be tapped down on the inductance. A capacity change takes place within the tube from the cold to hot condition and is therefore an undesirable effect which we are trying to eliminate. If the grid is tapped down on the inductance this shift due to tube capacity change decreases. For instance, tapping the grid down half way reduces the original shift to one quarter the value it was when the grid was connected to the end of the inductance. Therefore it is a worth-while improvement. However, when doing this parasitic troubles will be encountered. The parasitic oscillations can be eliminated simply by adding a resistor in series with the grid lead. The efficiency of the oscillator is not seriously impaired and further isolation is attained.

Ordinarily, in the attempt to gain stability, the padding capacity of the oscillator tank is set to a high value, 300, 500 or even 1000 $\mu\mu$f being common. Unless these capacitors are of the air dielectric type, drift may be expected due primarily to the heating of the dielectric material. Admittedly the heating is small, but even a small change is quite noticeable at the higher frequencies. By reducing the primary sources of trouble as outlined previously, a small air padder may be used instead of large capacity units with other than air as the dielectric. In addition a small tuning capacitor is also possible because of the decreased maximum to minimum capacity required to tune over a given range.

In the past a great deal of stress has been placed on temperature compensation. Properly designed circuits need very little. Considerable use has been made of negative coefficient ceramic capacitors. Difficulty has been experienced with large values of compensating capacitors, principally due to inferior retrace characteristics and substantial changes due to aging. The point is, to use components with as little drift as possible thereby requiring only a small amount of compensation. Of course, the preferred method of compensation is by means of a bi-metallic plate, but these are not readily available to the average amateur. It is therefore necessary to use ceramic compensators having a small order of effect. Should a warm-up period of 20 to 30 minutes be allowed, no compensation will be necessary for general amateur work. Most of the drift during transmission is due to the tube elements becoming warmer, and, unless a special compensator is pasted to the tube, absolutely no shift is not possible.* As pointed out in the discussion this effect can be minimized so that it becomes a negligible factor.

The test models included several with self contained power supplies and the others were built in the form of plug-in units, so that they would fit into a standard five-prong crystal socket. The crystal socket was wired so that filament voltage and plate power was available. The r-f output of the oscillators was arranged so that it was fed into the grid circuit of the crystal oscillator tube. In this way operation with either crystal or v.f.o. was possible by simply unplugging one and substituting the other.

The tubes selected were a 6AK6 for the oscillator and another as the buffer. The input and output capacities are very low and the element spacing is

---

*Special components have been recently announced that are designed to minimize initial warm up drift.—*Ed.*

small as compared with a 6SJ7 or 6SK7. The inductance was wound on a grooved ceramic form, the grid being tapped down half way from the hot end and the cathode tapped up five turns up from the ground. A negative coefficient 26-$\mu\mu$f ceramicon and a 50-$\mu\mu$f air padder were used as the band setting capacitors. The tuning capacitor was a 5–30 $\mu\mu$f variable and covered a range of 3.5 to 4 mc. The balance of the circuit follows standard practice. The second 6AK6 was the buffer amplifier thereby reducing external effects upon the oscillator. The inductance in the plate circuit of the buffer is *self tuned* to the center of the band. With a plate voltage of 200 volts sufficient output is available to light a neon tube. The static tests showed that from a cold start, the drift for a ten minute period was 50 cycles. During the next fifteen minutes an additional 10 cycles shift was observed. Under actual operating conditions, after a warm-up of 20 minutes, the frequency shift during transmission was not noticeable even after attention was called to the fact that a v.f.o. under test was being used. Frequency modulation in the form of a phase modulator may be added with no detrimental results in the operation of the oscillator.

LETTERS

(*from page 6*)

might question the need for 3 kc for a phone station or 1 kc for a code station, but in all fairness I believe this ratio is about right for the present or the forseeable future.

If we accept this 3-to-1 ratio and again use the proven 50-50 operation division, we come up with the following division for each major band:

Band (mc)	*Phone (kc)*	*Code (kc)*
3.5—4.0	375	125
7.0—7.3	225	75
14.0—14.4	300	100
28.0—29.7	1275	425

Code men will argue that phone operation might be conducted in such a way that it would not require 3 kc per station while the phone men will argue that full application of the single signal reception principle would reduce the bandwidth for a code station to less than 1 kc. All in all this seems like a fair division under present operating methods.

To carry out such an equitable division, certain minor problems arise as you pointed out in your editorial. Probably the 3.5–4.0 mc and the 7.0–7.3 mc bands are the easiest to allocate since these two bands are similar in nature, their primary usefulness being for short distance work. The 14.0–14.4 mc band is probably a tougher problem due to the presence of foreign phone stations working within the code bands. Possibly this condition exists to a certain extent on 7.0–7.3 mc also. One solution here might be to make 3.5–4.0 mc all phone band and 7.0–7.3 mc all code band, although this would not be entirely fair to the phone men. It would, however, solve the Canadian extra 50-kc phone band problem. A possible solution for the 14.0–14.4 mc band might be an F.C.C. rule making it illegal for an American amateur station to talk with any other station outside the band limits of the phone or code band in which it is operating. This would tend to discourage foreign phone band assignments within our code band limits. I feel it would be a fine thing if the code-phone band divisions could be worked out on an international basis.

John T. McWatters, W2CBK

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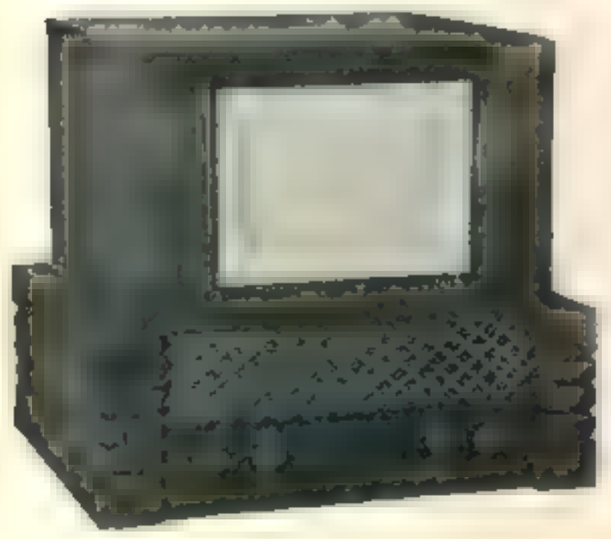

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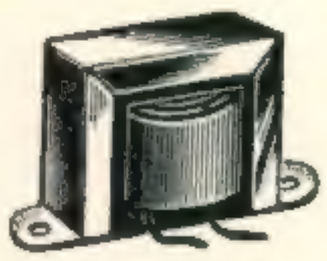

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CQ Ad Index

Allied Radio Corp. 75
Almo Radio Company 90
Alvaradio Supply Co. 84, 87
American Radio Institute 92
American Surplus Products Co. 58, 59, 60, 61

Babcock Radio Engineering, Inc. 70
Barker & Williamson 76
Bud Radio, Inc. 2
Burstein-Applebee Co. 91

Capitol Radio Engineering Institute 64
Communications Equipment Co. 77
Concord Radio Corp. 73
Continental Sales Co. 90
Crest Corporation 88

Delehanty Institute 89
Dow Radio, Inc. 55
Drake Manufacturing Co. 62

Eitel-McCullough, Inc. 12
Electric Associates, Inc. 92
Electro-Voice, Inc. ..... Cover 2
Esege Sales Co., Ltd. 82, 90, 92
Espey Mfg. Co., Inc. 78
Esse Radio Company 65

Fair Radio Sales 72

General Electric Co. (Tube Div.) 1
Gordon Specialties Co. 68
Greenwich Sales Co. 91

Hallicrafters Co. 10
Harrison Radio Corp. 53
Harvey Radio Co., Inc. 69
Heath Company 79
Henry Radio Stores 57

Instructograph Co. 85
International Resistance Co. 56

Johnson, E. F. Co. 85, 89

Kenyon Transformer Co., Inc. 74

Mallory, P. R. & Co., Inc. 8
M & H Sporting Goods Co. 81
Millen, James Mfg. Co., Inc. 4
Munger, Rex L. Co. 80

National Company, Inc. ..... 51, 87, Cover 3

Offenbach & Reimus Co. 82

Petersen Radio Company 5
Power Conversion Corp. 93

Radelco, Inc. 92
Radio Corp. of America (Tube Div.) ..... Cover 4
Radio Products Sales, Inc. 66, 67
Radio Wire Television, Inc. 96
Reliance Merchandizing Co. 80

San Francisco Radio & Supply Co. 92
Schuh's Radio Parts 84
Senco Radio, Inc. 92
Silver, McMurdo Co., Inc. 6
Silverstine, N. Co. 71
Standard Transformer Corp. 9
Surplus Radio, Inc. 93

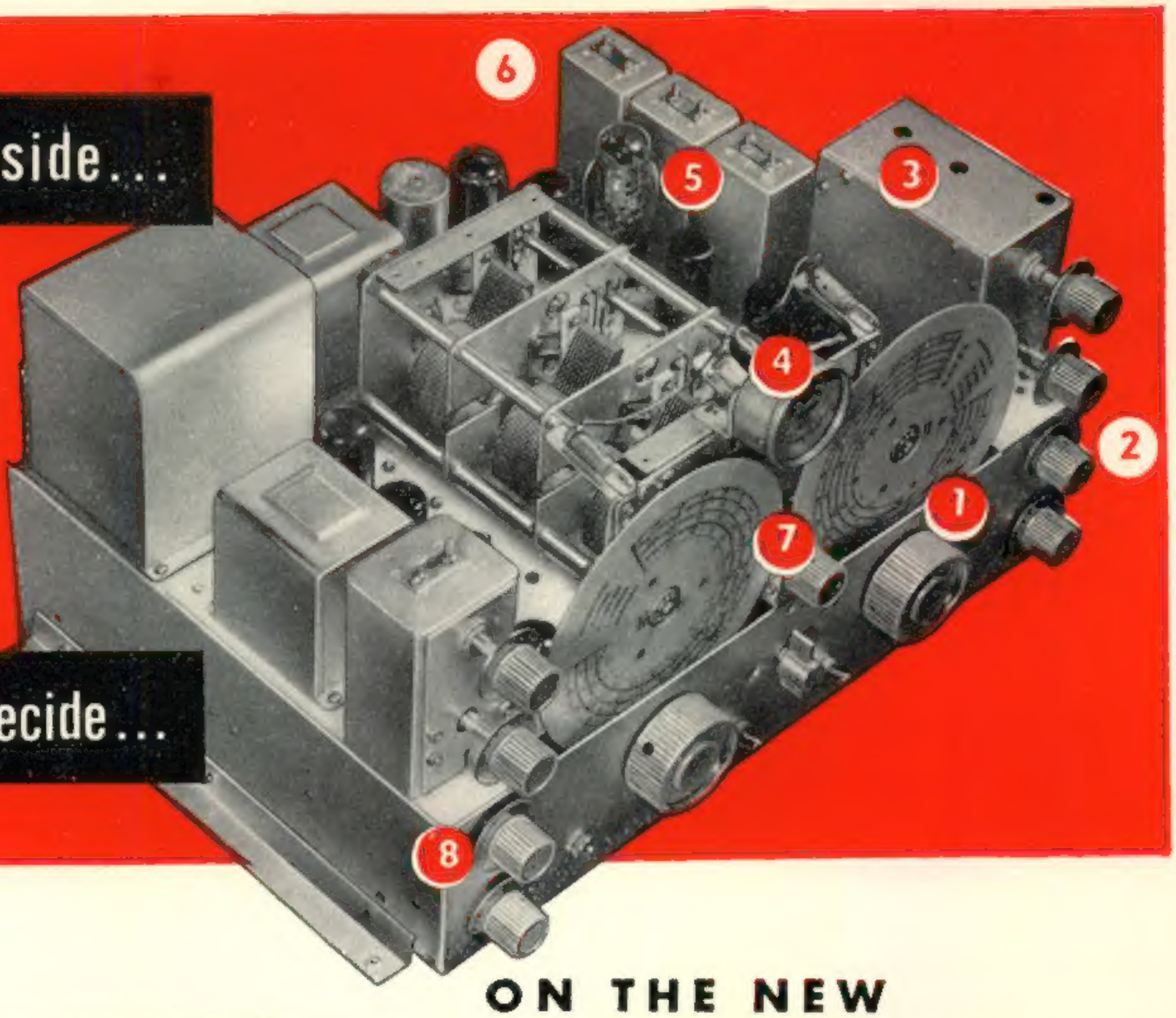
Tab 95
Telefem Radio Company 78

Universal General Corp. 87

V & H Radio Supply Co. 83
Vickers Electric 67

Webster-Chicago Corp. 7
Wells Sales, Inc. 63

see inside...



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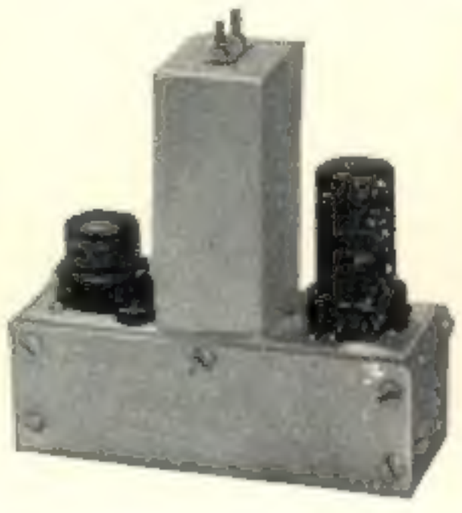

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